

UTILIZING TRADITIONAL ENVIRONMENTAL KNOWLEDGE IN INDUSTRIALIZED
NATIONS TO ASSIST IN DISASTER EVACUATIONS

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Dissertation Prepared for the Degree of
DOCTOR OF PHILOSOPHY

UNIVERSITY OF NORTH TEXAS

May 2013

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Lea, Brandi M. Utilizing Traditional Environmental Knowledge in Industrialized Nations to Assist in Disaster Evacuations. Doctor of Philosophy (Public Administration), May 2013, 143 pp., references, 97 titles.

Using traditional ecological knowledge (TEK), which is typically reserved for understanding how indigenous societies function successfully, and applying this to developed countries' ideas of disaster planning and response, emergency planners, public officials, and lay-persons can gain an understanding of their environment. Stories, history, education, and The waterborne evacuation of Lower Manhattan on September 11, 2001 provides a backdrop with which to test the tenets of TEK in a developed nation setting. This dissertation has found that TEK was effective when used by a developed nation and should be integrated into the current disaster system in the US.

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ACKNOWLEDGEMENTS

Funds for portions of this research were provided by the Multidisciplinary Center for Earthquake Engineering Research (MCEER) New Technologies in Emergency Management, No. 0010-81 and Measures of Resilience No. 99-32-01; the National Science Foundation; the Public Entity Risk Institute No. 2001-70 (Kathleen Tierney, Principal Investigator), National Science Foundation No. 0603561 and 0510188 (James Kendra & Tricia Wachtendorf, Principal Investigators) and the University of Delaware Research Foundation (Tricia Wachtendorf, Principal Investigator).

I would like to express my thanks to my major professor, Dr. David McEntire, committee members, Dr. Robert Bland, Dr. Abraham Benavides and Dr. James (Jim) Kendra, for their assistance in completing this dissertation. My sincere thanks go out to Jim for the opportunity to work on the research project that became this dissertation and for being a great mentor throughout this long, grueling process.

I must thank my family and friends for their constant mocking, teasing, and sarcasm about me not having a “real job” all these years. I’m glad you all can finally call me doctor, even if it is one that can’t write prescriptions. Whether it was making me copy out of the dictionary as punishment (which only served to expand my vocabulary), sending me to the World Book encyclopedia when I had a question I wanted answered (in the days before Google), or the historic “Death March Across Texas” in the summer of ‘89, my parents instilled a sense of learning that propelled me through this final step in my PhD. I must specifically thank my dad, who provided me with the tools to succeed when I was young and the money to achieve it when I was grown. I promise I’ll pay you back one day by putting you in a nice home that won’t abuse you.

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CHAPTER 1

IMPORTANCE

This dissertation will explore traditional environmental knowledge (TEK), utilizing it in the context of developed nations, which has been severely lacking in the current research on the topic. Specifically, the waterborne evacuation of Lower Manhattan on September 11, 2001 which was successfully carried out by the maritime community, will be studied to find instances of TEK that emerged in the evacuation. This study will show that TEK can be beneficial to not only developed nations in general, but also to emergency management officials in these nations who prepare for and respond to disasters.

Traditional environmental knowledge (TEK) is described in a set of theories developed by sociologists and anthropologists to explain how developing cultures use knowledge that is acquired over centuries, and passed down through stories, legend, folklore and songs in their daily lives (Berkes et al., 1995, Berkes et al., 1996, 282, Berkes and Folke, 1998). This knowledge is vital to the survival of a community over time by preserving long standing knowledge of how their environment works and helping populations understand how their culture fits into that environment.

TEK focuses on knowledge contained in informal sources such as stories, myths, pictures, and songs through generations. This type of knowledge does not traditionally incorporate western ideas and technology, but has been successfully used by indigenous people over the centuries to survive under harsh conditions. These theories also have applicability to disaster studies and may be helpful to explain human behavior under stressful circumstances.

Knowledge of the beliefs that cultures which have indigenous people are vital for their respective governments in order for authorities to how to work in conjunction with them with respect to environmental management in general, and hazard management in particular. Rodriguez et al. (2006) experienced this first hand by finding that governments associated with the 2005 Indian Ocean Tsunami had plans to relocate local fishermen inland in order to protect them from future disasters. However, the governments did not take into account that this would disrupt the normal habits of life in the fishing communities. Conflicts may result when government activities and environmental knowledge become intertwined.

For the most part, disaster scholars have not harnessed the uniqueness and telling ability of TEK (Johnson, 1992; Blaikie et al., 2007; Dekens, 2007). Research connecting TEK to industrialized nations is severely lacking (Stevenson, 1996; Sherry and Myers, 2002). Disconnect between the utilization of TEK in developing and developed nations may occur for several reasons. First, researchers have traditionally associated TEK and indigenous societies. Therefore, researchers do not appear to see its relevance outside of native practices. Second, researchers appear to conduct research in areas that are convenient or interesting to them, or for which funding is available. Though this tendency is not unique to studies of TEK, it does severely limit cases that can be used for theory development. Third, those who research TEK are often based within the anthropological field. As with many disciplines, there is not extensive crossover, or discussion, within other journals, conferences and departments. Though disaster researchers as a whole are very multi-disciplinary (studying public administration, sociology, geography, etc.), they have not been able to gain access to

every academic discipline. Nevertheless, the theory has been used to explain how indigenous societies perceive and respond to disasters. On the contrary, people all over the world, whether those living in traditional indigenous societies or those living in large cities, have all developed knowledge. This dissertation bridges the current gap within the disciplines and uses TEK theories to understand and explain disaster-related behaviors.

Purpose

This dissertation will explore the evolution of the theory of TEK as well as the contributions the theory has made to understanding human-environmental interaction in developing and industrialized societies. It will then discuss the method for observing TEK in an industrialized nation, specifically using the waterborne evacuation of Lower Manhattan on September 11, 2001 and the subsequent boatlift of supplies to ground zero. Utilizing this theory to explain and describe evacuation behavior is vital to demonstrating the TEK's value in disaster research. This will be done by answering the following research questions:

- What types of knowledge do responders to disasters in industrialized nations use in order to evacuate victims successfully?
- What type of knowledge was applied by boat operators during the waterborne evacuation on September 11, 2001, and the subsequent boatlift of supplies into ground zero?

Each question explores if TEK was utilized by boat operators and what type of knowledge they employed to make their decisions.

Method of Study

A case study approach will be taken for this research. The study was already conducted through a National Science Foundation Grant from 2005-2009. Originally, the

intent of the waterborne study was to find improvisation on the part of the maritime community in the disaster. However, in the course of reviewing the data, elements of TEK became visible. Therefore, it seemed prudent to further explore if tenets of TEK emerged or were relevant in this case.

The collected data was combed for particular themes that were identified as being inherent to TEK: stories, local knowledge, and history. This was done using the qualitative analysis software Atlas.ti and manually. Quotes that pertain to each theme, and other, more specific themes that emerged in the process were found through coding.

This dissertation focuses on the adaptation of societies to their environment during disasters, specifically in industrialized societies where technology and history have become just as much a part of their traditional environmental knowledge as the knowledge that developing societies have cultivated. This dissertation discusses the applicability of theories of TEK and how they relate to the conception of the term “disaster.” This dissertation also focuses on how TEK might inform policy interventions for response and evacuation of disasters. Indeed, utilizing TEK becomes even more urgent when we consider that the globe is urbanizing at an increasing pace, with nearly half of the world’s population living in urban settlements (Moore et al., 2003).

Broadening the theory to encompass the changing world has been overlooked by researchers; however, it is vital to explore its ramifications and benefits in order to move the theory of TEK forward. The benefits that TEK bring to the discipline of disaster research are very important. Because of the increasing cost of disasters, providing

government services and developing policies to prevent or mitigate the loss from disasters is vital to researchers and practitioners alike.

Organization of Dissertation

This section provides an overview of each chapter of the dissertation. There are six chapters including: the importance, literature review, methods, findings, analysis, and conclusion.

Chapter 1 consists of a description of the importance of TEK, the rise of disasters and how the theory has not yet been applied to industrialized nations and, specifically, disasters in industrialized nations. This leads to a discussion of how TEK has been used during evacuations, which has focused primarily on developing nations. This chapter also discusses the fact that this is a unique dissertation and the topic not been explored by other researchers. The uniqueness of the topic and methods of analysis are what makes this dissertation worth undertaking, so that it can add to the knowledge of both the emergency management and public administration fields. It is the hope that the reader will understand the importance of using this theory and utilizing it more than it has been previously used.

Chapter 2 includes the literature review. A discussion of the use of TEK during disasters is introduced. This includes industrialized and developing nations, since the topic has primarily been explored in developing nations. The importance of further expanding and developing this theory is discussed and blends into the importance of the study that has been undertaken.

There is a brief description of disasters and the effect they have on people and societies. This leads to a discussion of difficulties that arise during the evacuation

process of disasters. Specifically, evacuating large numbers of people during uncertain times with changing environments and information and what official and informal responders have done to combat these difficulties is explored.

The methods section of the dissertation comprises chapter 3. Data from a previous study are being used. However, the data is adapted using grounded theory methods to understand the use of TEK by the maritime community. Also, a justification for using a qualitative approach to studying disaster participants is presented.

The steps that were taken in finding and interviewing disaster participants, the snowball sampling technique, as well as a justification for using this technique are discussed. The importance of this qualitative approach is vital to understanding the thinking of specific disaster participants. Open-ended discussion questions were used to find what led participants to make the decisions they made. These allowed for examples of the theory of TEK to be discovered among their answers. This includes, why they knew they could overload their boats past government delineated capacity due to the existing knowledge of the vessels and what capacities operators knew they could handle.

Chapter 4 is the findings. However each of the transcripts has already been transcribed. Also, newspaper clips, pictures taken during the study, as well as pictures from study participants, and interviews conducted by the South Street Seaport were analyzed to create a cohesive picture of the use of TEK.

The transcripts were analyzed using the grounded theory method described by Strauss (1987) of finding themes within the data. Since this technique strongly recommends researchers to come to the data without any preconceived notions,

these themes were not discovered until the analysis began and were found through the “voice” of the participants.

The transcripts and other supporting evidence were analyzed, which created a list of specific themes found within the data. These themes were coded using qualitative analysis software (Atlas ti) and by hand (highlighting or underlining specific quotes from participants). As larger themes emerged, codes were found within these themes. These codes were the basis of analysis of the data because it provided actual, concrete evidence of TEK used by the disaster participants.

A code book (see Appendix B) was created by the codes that had been discovered from the themes of the data. This code book consists of the codes that were found and supporting quotes for each of the codes. The code book is included as Appendix B to the dissertation.

Chapter 5 is the analysis/results portion of the dissertation. This chapter takes the themes that have been discovered during the analysis and results section and make the data into something cohesive that scholars and practitioners can use to further the study of disaster. Also, it is the hope that the information uncovered will have an impact on disaster evacuation. Providing assistance and help with evacuating large numbers of people during disasters is essential to the purpose of this dissertation. Future research should focus on the benefits of local knowledge during all phases of emergency management in industrialized nations.

Chapter 6 is the conclusion section of the dissertation. This chapter serves to wrap up the findings of the research, as well as offer an overview of what was found in

the study. Also, recommendations for future research, and what direction research should take from this point on are discussed.

CHAPTER 2

LITERATURE REVIEW

In order to understand what gaps exist within the literature of traditional environmental knowledge (TEK) and disasters, a thorough review of the literature must be undertaken. This chapter serves to explore the origins of hazards and vulnerability in a broad context. Second, how societies adjust to hazards is discussed. This is broken down into two types of adjustment: using the TEK approach and a disaster management approach. Lastly, the chapter discusses how these two approaches can be combined into a comprehensive approach that incorporates the best aspects of local knowledge and technology in order to create an environment where all types of knowledge are used to combat hazards. By combining the two approaches into a cohesive approach, this dissertation seeks to fill the gap in the current literature, which has previously kept the two apart.

Hazards and Vulnerability

Hazards refer to natural or man-made events that affect an area. These can be flooding, earthquakes, oil spills, nuclear meltdowns, terrorist attacks, or train derailments, which are described as agents (Wiesner, 2003). Hazards are triggers that initiate disasters. Whether or not the agent affects a population, the agent is not any less (theoretically) dangerous.

Vulnerability is “the characteristic of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard” (Wiesner, 2003, p. 11) or other extreme event. How vulnerable a person or population is varies according to many environmental and socioeconomic factors. For

instance, age, education and income can have a profound effect on vulnerability to disasters. The inability or inexperience that may stem from these three factors can impede a person's ability to adequately prepare for a hazard or understand the dangers of a hazard. A person that does not have a large income may not be able to evacuate an area to escape a hazard. Also, they may not be informed as to how dangerous a hazard is to their area and, thus, fail to plan accordingly. Others may be vulnerable due to disabilities, race, or gender. The level of vulnerability is often contingent on socioeconomic status and proximity to a hazard. However, all people and populations have some level of vulnerability.

What is a Disaster?

When hazards and vulnerability intersect, a disaster occurs. The level and impact of the disaster is directly related to the type of hazard affecting a population as well as the level of vulnerability a population faces. Disasters are social occurrences which disrupt social functions.

A disaster is an event, concentrated in time and space, in which a society, or a relatively self-sufficient subdivision of a society, undergoes severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and fulfillment of all or some of the essential functions of the society is prevented. (Fritz, 1961, 655)

Without a population or society to affect, a tornado would not be considered a disaster.

If the tornado hits an open field that is uninhabited, there would be no disaster.

However, if a tornado, even a small one, hits a community, or society, and that society feels they have incurred losses to functions or members, then a disaster has occurred.

Perry (2006) identified some 30 different definitions of disaster, but Fritz's (1961) definition is most relevant to the work here.

Adjustments to Hazards and Disasters

People and societies do attempt to diminish their risk through adjusting and adapting to disasters. These efforts have been defined as “coping mechanisms” (Wisner et al., 2004) which are used before, during, and after a disaster to lessen the impact on an individual or society. There are many ways people adjust to the risk of natural hazards. Adjustment in a natural environment means building up social capital (money, resilience, social networks, etc.), to navigate successfully through the environment created by a hazard hitting an area. Geographical and hazard literature has explored how individuals and populations adjust to hazards within their environment. For instance, populations will evacuate an area when a hazard is impending, such as hurricane evacuations. Or, people will choose not to evacuate and, instead, stay in their homes and take protective or other measures like boarding up windows and storing food. These adjustments are defined by the individual’s ability to understand a hazard and change their actions to suit the threat. These actions are relegated to the person’s knowledge, social capital, financial resources, and perception of a threat.

Kates (1971) views adjustments in three categories: 1. folk/pre-industrial, 2. modern technological/industrial, 3. comprehensive/post-industrial. Those individuals or populations who use folk adjustments often look at hazards as uncontrollable by humans. The folk/pre-industrial approach uses traditional knowledge acquired by a population to make decisions on where and how to live. Instead, human behavior must be modified in order to be in harmony with nature. Often, only small groups or individuals are involved in the mitigation or response to hazards. These people focus on

living in harmony with nature to lessen their impact to a hazard; they do not try to change the way nature operates. This approach focuses on social norms of an area dictating decision making, such as building homes in an area that is not flood prone. Because there is little industrial adjustment to a hazard, has a large impact a hazard on a population if it strikes an area.

The second type of hazard adjustment described by Kates (1971) is a modern technological approach, which is defined by a population trying to control nature to lessen the impact of a hazard. This requires a great deal of social organization among a population. Though loss of life is less when attempting to adjust to a hazard by controlling it rather than living with it, damage can be high. This is because populations can settle into areas that would not have been viable without a technological approach to controlling the environment. A modern technological approach requires a great deal of social and technological involvement. However, it does not take into account that hazards cannot always be controlled by technology. For instance, providing dams to stop the flood waters is one way that the hazard of rising waters is might to be controlled.

The third type of adjustment is the comprehensive approach to adjustment combining both previous approaches. Though this approach requires more involvement from many different organizations and technological advances, this approach does take into account the adjustments made by those of the folk genre. It also recognizes the limitations of relying too heavily on any one type of adjustment. Instead, this adjustment is defined by spreading out risk by using more comprehensive adjustments to hazards,

by using knowledge and connections that are more advanced in technology, as well as utilizing the lesser folk ideas to combat disasters.

Adjustment to Hazards: Traditional Environmental Knowledge

As mentioned, one way that people attempt to adjust to hazards is through Kates' (1971) folk/pre-industrial approach, which attempts to create harmony within the natural environment and the people living in it. This type of adjustment is parallel to the anthropological disciplines' approach to traditional environmental knowledge (TEK). In order to better understand the context of TEK and its nuances, this section will briefly explore the broad base of the anthropological discipline and then, more extensively, how TEK enables populations adjust to hazards.

Anthropology, or the study of humankind during all times and places, seeks to understand different cultures and people. Within the broader range of anthropology, people, and their interaction with their environment, there are four subtypes of the discipline: physical, archeological, linguistic, and cultural. Each of these approaches describes the human experience in more specific way. Applied anthropological approaches are usually utilized within the four disciplines where an anthropologist interacts with the subjects being studied, if the desire is to take an active approach to problems that are encountered in the course of study. Anthropologists may use their research to help solve social problems or complex situations that are within a community they are researching (Haviland et al., 2010). The four disciplines of anthropology are discussed below. Cultural anthropology is discussed in more detail because this is the discipline that has been applied to the study of TEK.

Anthropological Disciplines

Physical anthropology looks at the way humans, and even other primates, have evolved and interact within their environment (Haviland et al., 2010). This takes a strong evolutionary approach to explaining the human existence. Anthropological work, such as Jane Goodall's work with chimpanzees, is an example of such research.

Archeological anthropology is the study of ancient societies through finding their remains (human, housing, possessions, etc.). By studying what was left behind by ancient societies, an anthropologist can attempt to decide how a society lived. They can also bring to light how a culture went about their daily lives and better understand their beliefs (Haviland et al., 2010).

Linguistic anthropology specifically looks at how languages, both written and spoken, affect cultures. How language changes over time and how a culture interprets language is essential to this type of study (Haviland et al., 2010). Understanding how language is processed by different cultures can allow researchers to understand the social problems that can come with differences in language and understandings.

Cultural anthropology, as a sub-discipline, seeks to understand how people and cultures interact within their environment and each other (Haviland et al., 2010). This is different from anthropological study because it looks at current cultures, not ancient ones. It also compares cultures by studying religion, society, values, and even politics.

Traditionally, cultural anthropology is studied through ethnography. Ethnography is participant-observation based research. Researchers embed themselves within a culture to understand how they approach life and society (Denzin & Lincoln, 2005). By acquiring knowledge of a specific culture by studying that culture in depth, aspects of

that culture can be found. Specifically, anthropologists will go in-depth with an aspect of a culture or society to understand how they make their decisions and operate within the world as a whole.

Traditional environmental knowledge (TEK) is the use of stories, song, legend, and history that allows populations to understand their environments (Burkes, 1992). This includes everyday occurrences in weather patterns, land formations, and disasters (flooding, hurricanes, tornadoes, etc.). TEK is studied using cultural anthropological methods, such as field research, imbedded research, etc. This has allowed researchers to understand how cultures interact within their environment, i.e. how they navigate their physical environment with stories, history, and cultural norms. Situated within the cultural anthropological discipline, TEK's focus has traditionally been on researchers embedding themselves within a developing nation's culture. This has allowed researchers to understand how these cultures use TEK to work within their environment. The following will discuss how TEK is currently being utilized in the anthropological world.

Current State of the Anthropological Literature and TEK

TEK has been a developing concept since the 1970s. The concept has evolved within the field of anthropology where researchers, including Berkes et al. (1996), Berkes & Folke (1998) and Thrush & Ludwin, (2007) focused on indigenous societies and how they adapt and explain changes in their environment. Initially, the concept lacked a specific set of rules to guide researchers as they explored TEK's application in multiple cultures (Johnson, 1992). Even today, there appears to be a lack of systematic

knowledge, or study of the subject (Iturrizaga, 1997; Thrush and Ludwin, 2007). Instead, researchers appear to pick locations where indigenous knowledge is easy to study.

TEK is used to explain how societies use their personal history in connection with their environments. TEK is a body of knowledge that is cultivated over time and passed down through generations, sometimes through stories, or song, written or by word of mouth (Berkes et al., 1995). For example, stories of natural hazards have informed cultures over time. Specifically, American Indians have been known to pass down stories of past tsunamis along the west coast of the United States, informing their cultures how to survive an unpredictable natural disaster (Thrush & Ludwin, 2007). This type of knowledge is different from contemporary knowledge, such as technical knowledge, that is produced through scientific processes. Scientific knowledge is rigorously produced utilizing theory, methods, and replicable results. It does not rely on stories or experience; instead, experimentation is key. TEK is developed through a “trial & error” process, which develops over time and as the environment changes, and is stored in a society’s cultural artifacts.

The tenets of TEK focus on the knowledge that is passed down through generations about an area, and people, in order to gain a greater understanding of the world and environment. It is often applied to farming practices, which allow indigenous farmers to know where and when to plant crops, as well as soil cultivation techniques (Blaikie et al., 1997). By passing these techniques down through generations, an essential database of best practices for the area can be developed. These best practices can be used to sustain their society, and survive.

Oftentimes, when indigenous peoples come in contact with the changing technology, conflicts arise. These traditional bodies of knowledge often compete with the new systems that have emerged because the new systems attempt to control the environment, while more traditional systems try to live in harmony with nature. These new systems usually emerge into that of the state, or governing bodies as technology in an area is increased. As more money is put into funding controlling hazards, there becomes a level of expectation that the best and most recent technology will be used to combat the problem. Technological advances can ignore the traditional knowledge because it can seem archaic and outdated to more recent practices. This can leave a community in turmoil, when the new laws and regulations are competing with the traditional knowledge (Sherry & Myers, 2002). Such issues have appeared in Canada, where development that will affect aboriginal land requires that consideration of traditional knowledge must take place by developers (Stevenson, 1996).

Ascertaining what local knowledge is, and how it should be applied, is difficult to define. Local knowledge can be used to either exploit or hinder traditional peoples. However, traditional knowledge should still be integrated into society for the benefit of all (Blaikie et al., 1997). Determining local knowledge can be done by consulting the native people of an area, or turning to historians, in order to gain information.

TEK is often applied to farming practices, which allow indigenous farmers to know where and when to plant crops as well as soil cultivation techniques (Blaikie et al., 1997). By passing these techniques down through generations, an essential database of best practices for the area is developed. These best practices can be used to sustain the local society in times of environmental uncertainty and hardship.

TEK is often associated with specific aspects found in a traditional societies' culture. These aspects include oral tradition, observation and hands-on experiences, as well as holistic, intuitive, and qualitative research, and collective experience (Johnson, 1992). TEK is based on oral and storied tradition from indigenous people. Storied tradition is knowledge passed down through generations in the form of stories. It can also be transferred through spoken and written word or even drawings and paintings. This can be collected by direct observation and hands-on experience. Often, this can also be done by the locals themselves. Their oral histories, stories, paintings, and traditions tell the story of their culture and give researchers insight into their beliefs (Johnson, 1992).

Traditional TEK also has close connections to the earth and the natural elements. Those who know and understand indigenous knowledge know the cycles of seasons and how they affect land, building and living practices. Local peoples who use TEK also understand terrain, such as rotational planting of crops, in order to extend soil fertility. Also, using ideas that have been passed down through generations, such as terracing hillsides in order to make the land useable for growing, are ways that TEK is incorporated into daily lives (Blaikie et al., 1997). Many of the beliefs and stories of TEK pertain directly to the earth, which affects all aspects of life. The earth and people interact and react on a daily basis.

Defining and using local knowledge to explain human behavior in a challenge for researchers (Oliver-Smith, 1996). However, integrating local knowledge into mainstream ideas needs to be done, specifically those ideas pertaining to natural resources, land, and power, held either by indigenous people because of their local

knowledge or by government officials by their money and technology. Indigenous knowledge should still be integrated into society for the benefit of all (Blaikie et al., 1997). Determining local knowledge can be done by consulting the native people of an area, or turning to historians, in order to gain information. Such studies have occurred in Pakistan and the Himalayas (Rautela, 2005; Iturrizaga, 1997) where, for example, land use planning was discussed.

TEK and Disaster Literature

For purposes of this study, search engines (Alternative Press Index, Anthropology Plus, Sociological Abstracts, and Web of Science) were canvassed using the terms traditional environmental knowledge (TEK) and indigenous knowledge (IK). These two terms were used because they are often used interchangeably (Johnson, 1992; Dekens, 2007). TEK is used to explain the broader phenomena of indigenous knowledge developed by cultures, while IK describes the actual knowledge possessed by a particular society. For the purposes of this dissertation, TEK is used as the broader term to describe the phenomena. IK, though it is a part of TEK, is a small part of the broader term.

TEK and IK were searched, along with the term disaster, in order to yield results of the phenomena and disasters together. Relating to Table 1, the term “western culture” pertains to the searches which yielded articles that were about disasters in western culture, i.e. the United States, Great Britain, etc. and not pertaining to traditional indigenous people, then the search engine was given a “yes.”

Theoretical development of the term “traditional knowledge” has focused the concept focused primarily on indigenous people, instead of expanding the concept to

other to “non-traditional” people, such as those living in large cities in developed nations. Though the definition of “traditional” is not considered to be stable or tied to indigenous people, it is often only used to describe indigenous people. Instead, Berkes (1992) described the primary issue faced with the use of “traditional” knowledge, which implies that practices and beliefs are developed from historical experience, which must be developed throughout societies over centuries. However, because knowledge is not static, Berkes (1992) noted:

Societies change through time, constantly adopting new practices and technologies, making it difficult to define just how much and what kind of change would affect the labeling of a practice as “traditional.” (p. 3)

What Berkes (1992) is suggesting is an expansion of the concept to include “traditional” knowledge that may not have developed over centuries. “Traditional” knowledge can be accumulated over a lifetime, or by having special expertise in an area. By acknowledging this, research can move on from the current trend of focusing on indigenous peoples - though the expansion of the concept does have its benefits to this sector - and devise new concepts for industrialized nations and the application of TEK to their “traditional” knowledge. Conversely, TEK principles can easily be applied to current emergency management practices in developed nations in order to have a complete picture of the knowledge that is available in order to save lives. Though some studies have been conducted, TEK must be explored more in terms of disasters in order to understand how formal and informal responses can apply “old” and “new” knowledge.

Search Engine	Traditional Environmental Knowledge (TEK)	TEK & Disaster	Indigenous Knowledge (IK)	IK & Disaster	Article with Western Culture & TEK or IK
Web of Science	704	6	2277	13	Yes (3 articles)
Anthropology Plus	168	0	789	2	No
Alternative Press Index	3	0	96	1	No
Sociological Abstracts	26	1	509	17	No

The four search engines that were consulted produced a total of 7 articles for TEK and disaster. IK and “disaster” had a larger number of articles, at 33. However, it must be noted that not all of these articles were directly pertaining to disasters and TEK and IK. Many of them were captured in the search because of the broad nature of the term “disaster.” As an example, Hutton et al. (2001) considered the depletion of the indigenous fish population and the subsequent rise of “trash fish” to be a disaster for one fishery, although this usage of “disaster” departs from its customary use by disaster scholars. Specifically, disaster scholars (Kreps, 1995; Stallings, 2002 a; Perry, 2007) look at disasters as social phenomena in which social problems (poverty, education, etc.) exacerbate disaster situations. However, Dynes (1998) believes disasters are “where communities must engage in efforts to protect and benefit some social resource” (p. 13). Specifically, Dynes (1998) explains that the society that exists before a disaster must be cultivated and cared for post disaster, so as not to lose its special nature in the aftermath of a disaster and its changing landscape.

Other terms were used, such as natural disaster, terrorism, tornado, landslide, etc. yet these were too specific and it was found that the combination of TEK and IK with “disaster” was the most beneficial in yielding the results that were desired for this dissertation. This is because the specific search terms did not allow for a holistic view of all uses of TEK theories and disaster research. Also, the combination of disaster types or events is endless, yet will not yield a larger amount of results as those search terms used. This makes it impossible to search terms such as flood, earthquake, drought, wildfire, tornado, hurricane (and its counterparts: cyclone and typhoon), etc. Yet, each of these is generally classified as “disasters” making the broader term the most useful to TEK theories used to study such phenomena. It is worth noting that the four search engines did yield duplicate results. Though some of the same articles were found, duplicates were eliminated because of the low number of results from the searches.

The gaps in knowledge of TEK and IK use in disaster research are apparent (as seen in Figure1). Just searching the terms does not yield high results of either topic (TEK or IK). However, there are many articles on TEK and IK, and they have not combined the concept with current disaster theory. Instead, the searches yielded almost no results on disasters and TEK and IK. There was also even less on disaster studies of western cultures that use the concept (see Table 1).

TEK and Indigenous People: Case Studies

Pakistan Mountain Settlement

The valley of Shimshal, Pakistan, has many natural hazards including yearly flooding, followed by rock and mudslides. Also, glacial dam breakage can create any one of the aforementioned hazards within the area (Iturrizaga, 1997). Though many

villages in the area have been completely destroyed in the past due to these hazards, settlers still inhabit the region because of its fertile soil, providing rich farming and grazing opportunities for its occupants (Iturrizaga, 1997).

The region lacks technological measures to warn, or protect, against natural disasters. Instead, the people have adapted to the mudslides (their most feared natural hazard), floods, and birds eating their crops in ways that have been passed down through generations by stories (Iturrizaga, 1997). The native people must plant and harvest crops in conjunction with nature. Residents must also live in conditions that are not always conducive to safety, and these conditions can easily destroy homes and livelihoods.

Residents of the Shimshal valley live and work with nature on a daily basis; however, nature tends to take its toll on the society. Instead of moving from the area, the people take an almost fatalistic view of natural events. Because of this, they do not appear to take direct protective action against natural disasters. The residents believe it is up to the fates in order to decide if they should live or die. They have adjusted to their uncertain environment by learning to live with the uncertainty it brings. However, they do shoot the birds that consume their crops, and move their grazing and crop production from places that they know are prone to flooding or mudslides (Iturrizaga, 1997).

The villagers in the Shimshal valley believe that the landscape is made up of personalities. Even the glaciers are viewed as living organisms and are separated into male and female genders (Iturrizaga, 1997, 325). These inanimate objects, because they have male and female personalities, can be subject to emotion. Anger, happiness, etc. can be conveyed by these objects in the form of performing acts, such as melting

glaciers, to show their feelings. Living as one with nature, these people accept what fates (happy, angry, etc.) nature gives them, even if this means destroying villages. They do take care to locate their religious buildings within safer areas in the village, because they view these buildings as sacred and important to withstand disasters. Their other buildings, including homes, are believed to be fluid and replaceable (Iturrizaga, 1997).

Himalayan People

The Himalayan people also rely on their knowledge in order to live within their environment. This is integral to success in their environment because people that experience a disaster and apply their local knowledge to the situation are often more likely to adapt and survive (Rautela, 2005).

Rautela (2005) found “indigenous people living in the Himalayans, an areas which is prone to earthquakes and flooding, were able to adapt by using their indigenous technical knowledge” (235) to forge new building practices to mitigate against these disasters as well as engage in conservation efforts to reduce the effects of drought. The indigenous people built their homes on higher elevations in order to combat the flood waters. They adopted farming practices that would conserve land for future generations. This did not happen through a government program or initiative. Instead, these indigenous people have been practicing in this type of life for hundreds of years and had adapted over time to survive.

Criticism of TEK

The words “indigenous” or “traditional” can lead to a belief that the concept can only be applied to native peoples. However, these words can also be used to describe

developed societies. However, the connection TEK has with developing nations can be lost given its intellectual origins in the study of indigenous practices. TEK as a type of knowledge is a survival mechanism for any culture in order to adapt and thrive in their environment. Harnessing this knowledge is vital to researchers and practitioners in order to lessen the impact of disasters in all settings.

Combining theories of TEK with already present in western culture and technology can advance the overall applicability of this concept. By not relegating the concept to indigenous people, the concept may provide a means to more effectively mitigate the losses of natural disasters.

The evident gaps in the knowledge of TEK provides an opportunity for better understanding of known behavior in disasters and to better prepare for their occurrences. Currently, the state of the literature appears to disregard knowledge that has been gained about TEK within industrialized nations. Though the previous research has been beneficial to building up the concept and expanding the tenets of TEK, it has not moved beyond its case research in less developed regions of the world. This may result from the lack of researchers using the concept, or the inability of researchers to think expansively about the concept. In order to develop the concept further, it should be used in a variety of contexts and applied to various fields.

Traditional environmental knowledge can be acquired by living or working in an area over time. It can therefore be argued that people living in cities can also build up indigenous knowledge of an area. Acknowledging the fact that knowledge is not static but changes over time, is imperative to the further development of the theme.

Many times the knowledge that is acquired through TEK could be categorized as “street smart,” where individuals use their acquired knowledge from experience and history in order to navigate the world. The traditional disconnect between what could be couched as “street smart” v. “book smart” (Van Eijck & Roth, 2007) is nothing new. These two sources of knowledge may be at odds with one another when applied to disaster knowledge. “Street smart” is having knowledge acquired through daily activities living in an area, while “book smart” is knowledge from formal education. In the United States there is a push to contain disasters with technology and western thought. Failures of technology, where it is used in favor of TEK, can exacerbate disaster situations. For instance, technological communication failures occurred on September 11, 2001 when cell phone tower attached to the World Trade Center were destroyed (National Commission on Terrorist Attacks upon the United States, 2004). Communication through cell phones was no longer available that day and impeded the ability to communicate with first responders, government officials, and victims. Also, failure of the levees in New Orleans led to extensive flooding in an area already hard-hit by the hurricane. Public officials and the public believed that the technological advances, the culmination of years of engineering knowledge, would save them from disaster.

The levees that surrounded New Orleans were meant to contain flooding from hurricanes. This was a technological solution to living in an area that was not traditionally used as habitable land. However, these did not prevent all flooding that could happen in the area. The public held a false sense of security because they were led to believe that technology was able to harness natural disasters. Unfortunately, the

technology did not. This does not mean technology was useless. Advances in technology have allowed warning mechanisms (sirens, Doppler radar, cell phone alerts) to reach large populations. However, overreliance on technology can give people a false sense of security. This, in turn, can lead to people being at risk for greater disasters, or being unable to escape disasters. Often, people's trust in technology can cause them to fail to acknowledge the limits of technology with costly consequences

Those who apply the concept of TEK often overlook how it is beneficial to industrialized nations (Iturrizaga, 1997; McAdoo et al., 2008). They focus on areas of the world, such as India and Africa, where the indigenous people use TEK on farming practices and building techniques. The current review of the literature shows that it does not appear to be the concept that falls short. Instead, scholars have not harnessed the potential of the concept by applying TEK in a broader sense - across disciplines and scenarios. They have not adapted the concept to fit the new, emerging knowledge that is being created every day, within both developing and industrialized nations. Having a strong understanding of local knowledge can help researchers explain how people act in particular situations and make decisions. This points to a lack of knowledge about TEK, as well as the inability of researchers to look beyond the current state of disaster management and response to disasters. Applying TEK to evacuations during disasters in industrialized nations is one way the concept can be applicable to researchers in other fields.

Instead of focusing on the technological aspect in industrialized nations that would prevent or control disaster, the local knowledge of an area should be consulted. This type of "street smarts" is beneficial because knowledge of an area - how an area

floods or the history of disasters in the area - can protect the public even more so than technology. Understanding what type of disasters can befall an area is vital to knowing how to combat it as well as how to prepare for such disasters (Oliver-Smith, 1996). TEK can potentially do this much better than relying on technological methods, or can be useful only because the history of an area can be passed down through local knowledge.

These studies have led to a bias in the concept. Because researchers have selected cultures to study out of convenience or based on personal interest, TEK theories have accentuated cultural biases. There are only a handful of studies focusing on a few areas of the world. This has limited the concept to explaining developing nations and their cultures, or other convenient studies. However, TEK could be used to explain behavior in other cultures, including industrialized nations such as the United States.

Adjustment to Hazards: Disaster Management Approach

The second way that Kates (1971) found that populations attempt to adjust to hazards is through a modern/technological approach. This approach has been extensively researched by scholars in the disaster-oriented fields, such as geography and sociology. Resilience is one way that communities have approached disaster management in the modern/technological approach. The following sections will discuss how resilience, sensemaking, warning, and evacuation are integrated into the disaster management approaches. Specifically, warning and evacuation behavior and how modern technology (radio, television, busses, etc.) can be used to remove populations from impending hazard can be found in aspects in sensemaking and resilience.

Resilience

Resilience is the ability to cope with disaster and ‘bounce-back’ with minimal disruption to life and systems (Bucklie et al., 2000; Kendra & Wachtendorf, 2003; Tierney & Bruneau, 2007). It has also been described as “the ability to respond to and recover from a disaster quickly, effectively, and efficiently (McEntire, 2007, p. 27). Also, social systems are often the focus of resilience, honing in on how an organization (a community, harbor of boat operators, firefighters, etc.) responds to a disaster and their ability to recover quickly from one. Resilience can come in many forms. People or a community can make themselves more resilient by making their home less susceptible to disasters (by using hurricane proofing methods) or preparing for a disaster by making a 72 hour disaster kit (Godschalk, 2001). Making a home more resilient to disaster is not the only way scholars have prescribed resilience. Comfort et al. (2010) describe the move toward a sociotechnical approach to resilience. This approach encourages policy makers to prepare for the unknown. Policy makers should encourage spontaneous volunteers, as well as use technological advances to the advantage of a societies’ resilience (Comfort et al., 2010). Though there are people who are more resilient than others (because of their access to money, resources, education, etc.), there are other ways that one can become more resilient without needing tangible effects.

Resilience is a theme echoed in many types of disaster research (Kendra and Wachtendorf, 2003), but this research rarely applies TEK principles and theories. Applying TEK principles could encourage societies to more effectively adapt to new and emerging disaster situations. This could be done by utilizing local knowledge and practices instead of relying on technology and government policies, which are not

always beneficial. Disasters, such as Hurricane Katrina, have exemplified how technology, such as flood levees, can fail and cause catastrophic damage. Specifically, overreliance on warning systems, which can fail if communications go down, or a levee break, which can flood cities thought to be impervious to such disasters, can cause technology to become obsolete to the destruction of a hazard., This can also cause local knowledge to come to light as the “best” option for a community.

In order to promote resilience in communities and adjust to hazards, emergency managers have a variety of options to use within their communities. The next sections discuss how emergency managers use warning and evacuation literature/research to best plan how to save their populations. Also, how sensemaking, improvisation, and emergence are themes found throughout the literature that promote resilience which, ultimately, leads a population to respond to disasters successfully is discussed.

Warning and Evacuations

“Throughout history, urban hazards and disasters have included a mix of natural, technological, and social events” (Mitchell, 1999, p. 138). Today many different types of hazards face large cities, and new complications are arising every day. Over half of the world’s population is living in large urban areas (Wenzel et al., 2007) and many of these urban areas are situated on or near the coast. These large urban areas have been called megacities and they “contain very large concentrations of people, buildings, industry and finance” (Uitto, 1998, p. 8). Those living in megacities are more vulnerable to disasters than people in other cities due to the high population exposure to a risk, and a complex and ageing infrastructure. Megacities can also be vulnerable because of their weak preparedness programs, due to the sheer size of these cities (Wenzel et al., 2007,

p. 483). Soon more than one-third of the world's population will be living in megacities of 1 million or more (Mitchell, 1999). Megacities are becoming more prevalent, and putting people at risk for natural and manmade disasters.

With 80% of the United States population living within 50 miles of the coast, millions are at a tremendous risk for natural disasters such as hurricanes which produce storm surge, flooding, wind damage and tornadoes (Lichterman, 1999, 1999). They are also at risk for tsunamis and erosion. Megacities are often built up around ports, which once were vital to commerce and trade around the world. Though, as discussed earlier, much of the trade has left these port cities, the megacities continue to grow, through the business of technological trade and the service industry. Also, as trade is moved to other ports, the cities around them will grow becoming large urban centers and put more people at risk to disasters from living so near the coast and residing in a large city. In New York, the shipping industry went into New Jersey. Overwhelmingly, global trade is by ship and is important to the world market.

Warning for disasters presents special considerations - including the dilemma of when to issue an evacuation order. Often officials may need to order an evacuation before they are certain their area will be affected (Perry, Lindell, and Greene, 1981). Officials need to understand that, though "crying wolf" can have detrimental public consciences, choosing not to order an evacuation has even more dire consequences. . It is better to order an early evacuation and not have a disaster strike, than to not order one and take a risk. Evacuation plans need to be made well in advance in order to accommodate evacuating an entire population. People need to be made aware of the plans and where their risk zone is with respect to a hurricane.

For disasters where there little or no warning time before impact, such as September 11, 2001, mobilizing appropriate public response can be challenging. Therefore, the public needs to be informed of the way warning and evacuation for these types of disasters happens before the disaster strikes (Quarantelli, and Dynes; 1977). This can be done through drills for fires or tornadoes. In addition, the public needs to be aware of what warning sirens mean, since such devices do not always mean one type of disaster. This is imperative because sirens do not give the whole picture of the hazard and can cause confusion, such as a siren for a tornado which is also used for a chemical spill. The public should be given more information on where to turn to find out about the disaster, such as radio, television, and internet outlets.

People will only heed a warning if they perceive that there is a true threat to themselves. This perceived threat comes from family members giving advice, warnings, and prior disaster experience. Drabek (1999) describes this as a “social process” that affects whether or not people decide to evacuate. Families tend to evacuate together, no matter what type of disaster, and they prefer to leave as a complete family unit. Research also found that people will leave a threatened building or other facility with the groups they came with, much like a family. Johnson (1998) identified this phenomenon in building fires, as did Connell (2001) in his research on the 2001 Trade Center disaster. People do not like to leave before their whole group is present, even if it means waiting until the danger is near. Emergency planners have grappled to understand that evacuations will not occur if people do not perceive risk and cannot leave with their families and groups.

Also, the types of warnings given are very important. They should be concise and provide the nature of the expected hazard, location, and the time of impact, and guidance in what to do. The warning message should be frequently repeated, specific, certain, clear and accurate. The warning should also be given by a single spokesperson that combines all the messages from official channels into one (Mileti and Peek, 2000). If people are unable to receive official messages they will get information from other sources. This includes relatives and friends. This information could be incorrect so it is vital that warning messages are given out by officials in a timely and complete manner.

In terms of tendencies to heed warnings and evacuation orders, research has shown that women and people who have young children are more likely to listen to authorities. The elderly, women and parents with young children are also more likely to evacuate. However, some features of a warning message may impede compliance. For example, warning messages are not always given in multiple languages. This has caused problems for non-English speakers that cannot understand warnings given of impending disasters (Aguirre, 1988).

Evacuations occur through official warnings and unofficial self-action during all disasters. Some of these evacuations are done orderly and official, such as when orders are given door to door or over radio or television. These evacuations are handled by the public officials responsible for evacuating the public. Other evacuations are done when danger is seen, and individuals decide to leave the area on their own.

People's perceived risk is directly related to the way they hear, understand and react to warnings. If they do not believe a warning they will not evacuate. Many different factors affect this perceived threat. Some individual and group characteristics,

such as family ties, and ethnicity are stronger predictors of how people will react than age or gender (Drabek 2000; Mileti & Peek, 2000; Kirschenbaum, 1992). Overall, many factors will determine whether or not someone listens to warnings and evacuates during a disaster.

In general, warning and evacuations are ways that developed nations attempt to cope with the uncertainty of hazards and disasters. The literature of how these have, or have not been successful, is extensive when discussing developed nations. However, the literature traditionally takes the approach of looking toward the technological aspects of warning and evacuations and does not always integrate traditional knowledge.

Improvisation (Bricolage)

Improvisation, which is reacting to the immediate environment with action, creative responses, etc., is essential to disasters. In fact, Tierney (2002) believes that there must be some element of improvisation in order for an event to be considered a disaster. This means that if an event was able to be fully planned for, there would be no surprises, no ambiguous scenarios. However, disasters themselves create uncertain environments. Some disasters do give large warning times (slow onset disasters), yet these are still unpredictable in the extent of their damage capabilities, etc. As for rapid onset disasters, their unpredictable nature (when, exactly where, how long) leads to improvisation to combat the uncertainty of the disaster.

In order to understand how one becomes more resilient, Weick (1993) provided specific examples of how the failures and successes of firefighters at Mann Gulch constitute a culture of resilience. The Mann Gulch fire claimed 13 firefighters lives while

fighting a wildfire on a mountain. Those who perished did not follow the orders of their superior officer, who was able to quickly assess the changing situation and make improvised decisions to save lives. Weick's (1993) theory of sensemaking, or making sense of one's environment, is made up of four tenets which facilitate sensemaking in response to a changing and uncertain environment. The theory frames situations in an environment as having meaning. This allows individuals to create a shared awareness of their environment and situation in order to understand their meaning. Sensemaking is closely related to improvisation (bricolage) and emergence, which will be discussed in detail below. These principles are essential to being able to carry out the focus of an organization in times of crisis or uncertainty. For instance, the firefighters in the Mann Gulch fire were successful if they followed these tenets, but for those who could not grasp these four, death occurred.

Improvisation in disasters takes many forms. However, it must be noted that these forms are not chaotic. Instead, improvisation in disasters is a way of dealing with the chaos that is caused by the situation. When improvisation takes place, there is some element of previous experience or knowledge which the person or persons uses in order to navigate the unknown environment. This allows them to adapt to their changing environment more quickly and encourages creativity in order to understand that environment.

Resilience, sensemaking, and improvisation are ways that current scholars have found that populations combat the effects of disasters. This does not mean that they live in harmony with their environment. Instead, people have found ways to cope with the uncertainty that living in a rapidly changing environment entails.

Emergence

Emergence is “ad hoc and temporary groupings being formed after [disaster]” (Quarantelli, 1983, 2). Emerging groups focus on relevant tasks, i.e. mobilizing resources, giving public information, search and rescue (SAR), medical services, clean up, and repair. (Quarantelli, 1983). For example, SAR activities were conducted during the 1992 Guadalajara gasoline explosion based on “volunteers’ social identities in peer groups, extended families, the neighborhood, and the Catholic Church” (Aguirre et al., 1995, p. 1). These activities were conducted by emergent groups that formed to rescue their neighbors, friends, and family.

Prince’s (1920) doctoral dissertation, which looked at the Halifax shipping explosion and the emergent response that formed, was the premier study on emergent behavior. This and other beginning research, which were mainly case studies exploring the particulars of what people did after a disaster, led sociologists to ask why and how emergent groups formed, not just what they did after formation.

Sociology has been the primary discipline to research emergent groups after a disaster. For instance, the Disaster Research Center (DRC) at the University of Delaware has been the forerunner in developing grounded theories about emergent behavior. Although, there does not seem to be a clear consensus on the term “emergence,” (as discussed previously) the DRC has developed a typology as the basis for much of the understanding of emergent behavior in disasters. Over the latter half of the twentieth century, many advances in the research of emergent behavior have taken place, which expanded previous theories on emergent groups and helped explain what, who, and why individuals provide assistance voluntarily in disasters

In previous studies, scholars focused on self organizing mechanisms, by observing who organized after a disaster and when emergent groups came about, whether immediately after a disaster or in the hours or days following. They also focused on tasks performed by these emergent groups, or what they did. During this time, emergent groups formed out of a necessity for assistance because there was no government entity established to help in times of disaster.

At times, emergence or convergence can lead to volunteers because neither of these are usually part of an organized group. Instead, they are ad-hoc entities which develop when a need for them arises after a disaster. Emergence is the term first coined to explain the helping behavior seen after a disaster. It is those people who are at a disaster site immediately after an event, locals who help with search and rescue (SAR) or other immediate helping activities. Convergence includes those people and resources who are from outside the disaster area that come to the site to help. They are not immediately affected by the disaster, but feel compelled to converge on the scene and help. Convergence can lead to emergence if convergers arrive and see there is a void that needs to be filled. Many times it is volunteers who are performing the emerging and converging behavior, though public officials are also involved. In this instance citizens who are not affiliated with a particular group or organization coming to provide assistance after a disaster are volunteers.

Immediately after disasters strike, emergent groups often form to respond to the aftermath. Drabek and McEntire note that “disasters, by their very nature, lead to emergence and require the participation of multiple actors whose legitimacy is derived

from alternative authority sources” (Drabek and McEntire, 2003, 108). Emergence, by its very nature, has led to complications when utilizing the incident command system.

Although there has been much debate on the composition of emergent groups, Stallings and Quarantelli (1985) note the diversity of individuals involved i.e., they can be solely from the public sector or a mix of individuals from both the public and private sectors. They are important to the successful response and recovery because emergent groups occur spontaneously; they are often ad hoc, unplanned, and informal.

Criticism of the Disaster Management Approach

Of course, disaster management is frequently imperfect. Warnings and evacuations can go unheeded; there are limitations to resilience, such as income and education, and people who converge on a disaster scene can cause more harm than the good they intended.

Warnings and evacuations have been ways that the developed world has tried to cope with disasters. This is done by informing the public of an impending hazard, and trying to move the general population away from the threat. However, this is not always successful. For instance, breakdowns in warning and evacuation procedures can result in catastrophic consequences. Hurricane Katrina is one prime example of this.

Repeated warnings were not strong enough, or heeded by the population to evacuate. That, coupled with limited transportation capabilities, since many people did not have cars or other transportation, and routes were congested with many people leaving, led to people being trapped in New Orleans when the hurricane hit.

Evacuating large populations of people is one of the most difficult aspects of disaster management. It requires “the considerable application of resources, principally

manpower, communications and vehicles” (Alexander, 2002, 151). Many times moving millions of people successfully is not planned for because the task is large and daunting and seems unlikely. In fact, even the plans written are often referred to as fantasy documents because they are impossible to implement or they do not reflect the actual practices that will take place in order to evacuate an entire population (Clarke, 1999).

Policy makers and public officials in charge of disasters have had difficulties dealing with emerging groups (Quarantelli, 1983). For instance, from an operational standpoint, Quarantelli (1983) recognizes the difficulty in handling influx of emergent groups and volunteers in addition to provide basic infrastructure to affected communities following a disaster (Quarantelli, 1983). The problem is more acute when volunteers who do not have vital roles or the necessary skills hinder the response and recovery efforts. Kendra and Wachtendorf (2001a) observed the behaviors of emergent groups after September 11th in the Emergency Operations Center (EOC) in New York City and noted the presence of unauthorized individuals or those who were not applicable to the response efforts such as chiropractors, as well as other emergency activity.

The problems that arise when dealing with emergent groups are not unseen, such as incorporating a large influx of volunteers into a rigid organizational structure and making sure volunteers are performing the correct tasks and not putting themselves or others in danger. This can be anticipated in advance and planned for. However, if the plan is only a fantasy document, it will not be helpful.

Though there are challenges in applying research findings in the disaster setting, the benefits of this approach are great. Understanding how and why people heed warnings and evacuate is vital to planning. So too, is understanding who can “bounce-

back” from a disaster and what types of help to expect from victims and others after a disaster.

Filling the Gap in Current Literature

There is currently a gap between traditional disaster management practices and current practices. This dissertation will attempt to fill the gap in the current literature on how theories of TEK can connect to western or industrialized settings. Specifically, how TEK can be integrated into technological advances, ideas, and the western world, in which live societies that often try to combat nature, instead of live with it. The two hazard reduction approaches described by Kates (1971) were suggested to be integrated into one, a comprehensive approach. This approach has been used by some, which will be discussed below. However, the full benefit of integrating local knowledge and technological knowledge has not been realized within the current state of the literature.

Currently, there is some discussion of disasters in the context of western technology and the integration of TEK, yet such effects are often couched in terms of a vague “local knowledge” held by those facing disasters (Hageback et al., 2005; Thrush & Ludwin, 2007). Much of the discussion about TEK is related to developing nations and what the indigenous people do in order to combat disasters and risk. Typically, there is no direct link between the term TEK and disasters. While some scholars periodically connect the two (Iturrizaga, 1997; McAdoo et al., 2008), there is still insufficient research that links the concept to disasters in developed society.

Integrating the adaptability features of TEK along with indigenous societies’ differences’ with political, economic, social, and environmental ideas has been a tenet

of the new literature of TEK and disasters (Batterbury and Forsyth, 1999). The theme of adaptability, which relates directly to TEK, has emerged in thinking on climate change and other environmental stressors, that can lead to dangers (drought, crop failure) in indigenous societies (Hageback et al., 2005). Flooding, extreme weather, pollution, and drought can all lead to indigenous societies being at risk because they often live in difficult environments and rely on the land. Mitigation to these problems usually focus on sustainability practices or housing techniques, such as building on stilts to reduce the risk from floods or crop rotation, so as not to exhaust the soil, rendering it unusable.

In adapting one's behavior to the situation, people can become more resilient to changing situations. Artful application of TEK can promote resilience and adaptability. When the disaster researchers started to take into account these two themes, they inadvertently started to integrate some concepts of TEK. TEK led researchers to better understand the socioeconomic and cultural issues that not only lead to disaster, but also exacerbate disaster situations (Wisner et al., 1994).

However, Parker and Handmer (1998) utilized TEK principles in their study of flood warnings in the United Kingdom. They found that people relied on the previous knowledge of where flood waters would rise in order to determine if they were at risk. Also, they found that people sought to confirm official warnings through friends or family and other means that were less official "the other way" that they received information, before deciding to take protective action (Parker and Handmer, 1998). This reliance on the old way of receiving information proved to be detrimental because some received misinformation from friends and family members about the flood and chose to believe these trusted members over public officials. Also, some who relied solely on the

traditional way of receiving messages about the flood received a warning too late. This study is one of very few that integrates TEK and developed nations. Research pertaining to non-indigenous people in disasters and TEK has not been explored to the extent that it has with indigenous societies.

If TEK and local knowledge is to be utilized with more advanced emergency management techniques, such as official warning, it is imperative to understand how integrate the system into all phases of emergency management. However, this can be difficult. The local way of preparing for and adapting to disaster has been replaced, at times to the detriment to the citizens (Parker and Handmer, 1998). As Parker and Handmer (1998) found, people still rely on traditional means of communication. They suggest incorporating local knowledge to allow citizens to respond to disasters the way they have adapted to. Such a suggestion points to a need for a cohesive warning system, that effectively menses traditional methods with more technical methods. Currently in the literature, this is the one specific example where actual TEK principles were applied to an industrialized nation.

Integrating the two approaches to hazard adjustment (folk/pre-industrial and modern/technological) into the comprehensive approach discussed by Kates (1971) is what this dissertation will attempt to do. By using traditional knowledge, and combining it with western approaches to disaster reduction, evacuation, and hazard vulnerability, a developed society can integrate two seemingly opposite approaches and use them together to lessen the impact of disasters. This dissertation will show how this can be successful by exploring the waterborne evacuation of September 11th and how the

maritime community used their local knowledge, as well as their current technology, to successfully evacuate those affected by the collapse of the World Trade Center.

Many western cultures have utilized an emergency management approach which utilizes technology to lessen hazard impact. However, many developing nations still use a traditional approach to hazard management. Mankind has attempted to control hazards by living with them, working around them through technology, or, in less intently studied cases, using a combination of local knowledge and technology to combat hazards that lead to disasters. This chapter has discussed the merits of both approaches, and suggests utilizing a combination of the two, which creates the third and more holistic approach. The case for combining these two approaches in a western world context will be made in this dissertation.

CHAPTER 3

METHODS

This dissertation expands upon a previous study on the waterborne evacuation of Lower Manhattan on September 11, 2001. The methods used in the original study will be discussed in this chapter. Then, how this study was expanded upon and how the information will be used to better understand the use of TEK in developed nations will be explored. Also, how data were stored and steps taken to ensure confidentiality can be found in this chapter.

The original study to guide participants through their experiences evacuating people on September 11, 2001, broad questions guided participants in a narrative through evacuation of Manhattan on September 11, 2001 and the subsequent boatlift of supplies in the days after the disaster. The narrative produced by these questions inadvertently offered insight into the training, education, history and other aspects of TEK in the maritime community in New York Harbor, thus allowing me to use the data that was collected for the current study.

Original Study

The data for this dissertation were collected through a grant from the National Science Foundation (NSF) No. 0603561 and 0510188. The original study was with the University of Delaware's Disaster Research Center and the University of North Texas. Focusing on the waterborne evacuation of Lower Manhattan on September 11, 2001, the study aimed to understand how skills developed by members of the maritime community from working in New York Harbor daily, and previous experience such as education, harbor drills, and participation in previous rescues on the water extended

itself into a rapidly changing, informationally-sparse environment. The study sought to determine if participants used their knowledge and incorporated it into improvisational activities, such as loading passengers onto boats.

Sensemaking is the act of giving meaning to experiences or making “sense” of one’s environment through previous experiences. Past experiences are used to understand a current situation. This can be done through an individual or through a group’s experiences. The individual or group learns to adapt to their environment because they use prior experiences to understand their current situation and circumstances (Weick, 1995). A number of questions highlighted how study participants defined their environment and how they would proceed as events unfolded. For instance, why did the respondents choose to evacuate how they did? What types of information were they receiving that helped make these decisions? And, who they were working with when these decisions came about? These inquiries were used to elicit responses pertaining to sensemaking. An important aspect of the study was to understand who participants had worked with prior to the disaster in order to better understand the relationships that were formed, or reconnected, on the day of the event. For example, boat operators were asked who they interacted with on that day and who they had known before the disaster. This was important to establish a sense of history that contributed to the knowledge in the maritime community. Boat operators were also questioned about their education on the water and their experiences in the maritime community. Though these questions were originally asked to better understand how the boat operators worked within the parameters of the harbor, they also offer insight into the harbor community. Therefore, the questions asked in the original study and the

data found are related to TEK and developed nations. For instance, questions were asked about what types of improvisation took place on that day. Improvisation is a key component in TEK because the knowledge and ability to ascertain what one has versus what one needs is instrumental in understanding the environment one is living in.

Participant Selection

Sampling for this study was done using a snowball sampling technique. Snowball sampling uses a chain process to find participants in a study (Singleton and Straits, 2004). Initial participants were found through mariner trade magazine write-ups and a local museum exhibit on the evacuation. From this point, participants were asked who they worked with on 9/11. This allows not only a way to find individual participants in an event, but also reveals a network of disaster participants. In this particular study, previous interviews conducted by the South Street Seaport Museum and articles written on the event were used to find the first participants. The museum is located in Lower Manhattan and provides patrons with a view of the maritime industry in New York City. This is done through exhibits, research, and publications on the history and events in the harbor. These interviews consisted of personal experiences of the participants on the evacuation of Lower Manhattan: how they evacuated, where they evacuated, and how it was successful. Then, these participants were asked to provide names of those they interacted with during the evacuation or who they knew participated.

This sampling method was necessary due to the ad-hoc nature of the event. Most participants were not registered on officials' logs or with the official response. This was due to the fact that logs were not kept properly on that day because transporting passengers became the main focus and log books were not a priority for the boat

operators. Also, some participants came to help in an unofficial capacity, either without asking permission from their respective employers or by suspending regular operations and responding. Only by word of mouth, and a small number of previous interviews, was it possible to track down so many who participated in the evacuation.

Gaining Access to Site

There was no particular “site” to complete our research. Instead, many different organizations were contacted in order to collect data. In this process, searching the internet for the direct number of the person (cell phone, office number) that we wished to contact was important. However, myself, the principal investigators working on the project (Dr. Kendra and Dr. Wachtendorf), and other research colleagues at the University of North Texas and the University of Delaware did come in contact with gatekeepers (Feldman & Pentland, 2003) who did have an aversion to allowing us access to potential participants. There were times that these gatekeepers did not allow us access.

Data Collection

Data were collected from interviews of those who participated in the waterborne evacuation of Manhattan after the 9/11 terrorist attacks through structured interviews, as well as existing interviews already discussed (i.e. South Street Seaport Museum). A structured interview is one in which “participants [respond] to a set of questions derived by the analysis of previous data” (Corbin & Strauss, 2008, p. 208). Conducting interviews in this way were necessary in order to allow participants to tell their story while keeping them focused on the topics that were being researched.

Though it is feasible for disaster researchers to conduct studies during the recovery phase of a disaster (Stallings, 2002), the large undertaking of the study was not done until well after the event. The interviews were conducted four to five years after the disaster, from January 2006 to October 2006, due to funding and time constraints. This did lead to participants forgetting some events of the day and specific times that they performed actions. However, after comparing many interviews, as well as reviewing news reports and documents generated at the time, a more cohesive picture of the events of that day was created.

Interview Particulars

The length of the interview depended on the participant's willingness or ability to talk, as well as the extent of their involvement in the evacuation. The participant was asked where they were when both planes crashed into the towers, where they were when the towers collapsed and how they became involved in the evacuation. They were then asked what types of improvisation were used in the process of evacuating victims. All of these questions served to understand why the participant chose to evacuate, what parts of their history, etc. led them to help, and how they used non-standard means to evacuate victims. Conducting these in-depth interviews allowed rich data from participants and allows me to "understand, rather than to explain" (Denzin and Lincoln, 2005, 706) what participants are experiencing.

Interviews lasted from 60-90 minutes depending on the experience of the participant and how much of a story respondents had to tell. One interview was clearly an outlier and took eight hours to complete. I personally spent two weeks interviewing participants during January 2006 and June 2006. These interviews were done in the

New York/New Jersey area either by UNT or UDEL researchers. Those who participated in the evacuation that still lived in the area were interviewed in person (see Appendix A).

Participants were digitally voice recorded in person or over the phone. All efforts were made to interview participants in person. However, it was not possible to interview all of them in person. Some participants had moved away from the New York/New Jersey area. For those participants being recorded over the phone, a special device was used that connects the digital voice recorder to the phone.

Participants were informed that they were being recorded, and they consented to the recording “on tape” for the IRB process. These recordings served as the basis for the transcripts. Recording participants allowed me and the other researchers on my team to ask probing questions or clarify responses that appeared during the course of the interview. The digital voice recording also serves as a useful tool to understand intonation or emotion of the participant when particular questions are asked. One hundred interviews were then transcribed by students at the University of Delaware that were employed using the NSF grant. Transcriptions are stored both electronically and on hard copy.

Adapting the Previous Study

The waterborne evacuation study was adapted for the purposes of this dissertation. Though the previous study produced raw data that can be used in many different analyses, the original study sought to build upon Weick’s (1993) sensemaking theory, which will not be the focus of the current study. Weick’s (1993) study also attempted to explain how improvisation and resilience affected convergers (those who

come to a scene after a disaster) on a disaster scene. This is one major basis for the original study.

Through the course of the previous study, the questions that were asked inadvertently found that traditional knowledge was used extensively by the participants. The following is how the previous study was analyzed and adapted to find elements of TEK used in the maritime community during the waterborne evacuation of Lower Manhattan.

Data Analysis Procedures

Using the data collected from the primary study mentioned above, this dissertation produced a narrative on TEK and how older technology and information can be used to benefit those in disasters. Specifically, the dissertation addresses how TEK is used in the evacuation process and what improvisational techniques related to TEK were used in the waterborne evacuation. Since improvisational elements appear to be intrinsically linked to TEK, yet have not been discussed in either type of literature, it is imperative to explore these nuances. The data analysis consisted of five phases.

First and Second Phases

The first phase of the research was to collect the data and this has already been accomplished as discussed in the section above, from the previous study. The second phase consisted of analyzing the data in an informal manner after each interview. Though this is the second phase, it was conducted concurrently with the first. After each participant was interviewed, a debriefing took place among the researchers, usually at the location where the interview took place or in the car ride back to the hotel or on the

way to the next interview. Notes were taken/reviewed during this time and these notes are being consulted for clarification during the analysis phase.

Participants were also asked where they were located in the harbor that day, what vessel they were on, where their trips took them, and how many of these trips they took. These locations were captured on a harbor chart that the participants were encouraged to mark on. Their charts include their vessels, direction, who they interacted with or saw along the way, and those locations they saw those they interacted with. Most importantly, the times they participants conducting their various activities was attempted to be determined. The harbor charts will be utilized if participants marked what piers they used, specifically if these were closed piers, or not normally ones that were used.

Third Phase

The third phase was to transcribe the data. The transcriptions were completed by researchers at the University of Delaware. One hundred interviews were transcribed verbatim from 2006-2008. These transcriptions allowed me to read, and re-read what participants have said. Oftentimes, this leads to the discovery of meaning that was hidden before when only listening to the interview. However, interviews with digital voice recording were listened to while re-reading the transcripts to get a better understanding of what a participant is trying to say. The transcriptions were available to me through email which had been Ax Crypted in order to ensure confidentiality. I used these electronic copies to complete the fourth phase.

Fourth Phase

The fourth phase was to analyze the data using grounded theory method and utilizing ATLAS.ti as the system to aid in coding. Coding is relating concepts to each other by “breaking data apart and delineating concepts to stand for blocks of raw data” (Corbin & Strauss, 2008, 195). The data that is broken apart is put into categories, in this instance categories of TEK, as blocks of quotes from interview data. The quotes represent examples of TEK being used by the maritime community. This phase is conducted after the study has taken place and all interviews are completed. ATLAS ti is qualitative analysis software that allows the user to input transcripts into its system. Within this software, the data can be coded and categorized into themes.

The coding that took place was done using grounded theory. Open coding is a method used in grounded theory to comb through data that has been collected through interviews, pictures, video, or writings without preconceived notions of theory or what data one is looking for. This type of coding breaks apart data and delineates “concepts to stand for blocks of raw data” (Corbin and Strauss, 2008, 198). Breaking out sentences, phrases, and paragraphs through open coding allows transcribed data to become useful and illustrate n the themes of TEK. All codes started out as free nodes, which is the most open type of node for open coding. These codes will not be specific. Instead, free nodes will show some sign of TEK, in the form of a category such as history. As themes emerge, they were arranged into tree nodes. Tree nodes, also known as axial coding, relate concepts to each other, or relate the broader free nodes to each other. For instance, there can be multiple free nodes that depict history of the maritime community in New York Harbor. Grounded theory is used to build theory from

data that has been collected prior to formulating a hypothesis (Corbin and Strauss, 2008). Used as a way to conduct qualitative analysis, grounded theory is a way to gain understanding and develop knowledge through extracting data from transcribed interviews, pictures, or video. By working backward to develop a theory, the data can extract information that was not sought during the original interviews of participants (Corbin and Strauss, 2008).

Grounded theory methods were used to find patterns and quotations from study participants on how they interacted with people that day, what types of technologies or improvisation they used to evacuate people, and how their histories and previous experiences played a role in their participation in the evacuation. Specifically, the dissertation will seek to understand how these elements affected their ability or the way that they evacuated victims on vessels in the harbor.

Themes of TEK have been identified from other scholars (Johnson, 1992; Berkes et al., 1995) These (history, education, stories) were used for the themes of this study. Anything that appeared to pertain to TEK and its themes including: resilience, improvisation, history, stories, and experience was coded. The coding process consisted of canvassing the transcripts by hand and through using the Atlas-ti system of qualitative analysis. Free nodes included are: history, education and stories. For example, a free node that fit the theme of "History" is: "years of experience in the water and working and knowing the geographical familiarity of the port of New York. We were in our home port". (Participant 39). As the coding proceeds, these open codes will turn into specific themes. These themes may take the form of "passed-down knowledge, stories, or written histories," which are general themes of TEK. It is imperative to keep

coding open until specific themes are discovered in order to find all of the possible codes. Open coding does not automatically limit a researcher because it does not entail preconceived notations of what “should” be. The themes that are created will then be used to describe how TEK was used in the evacuation.

The broad area that this research and interview guide (see Appendix A) covered pertained to improvisation in changing environments. From these questions, preliminary assessment reviewed elements of TEK.

Through the analysis, there will be some interviews that are not useable for this study. This was foreseeable because the original study did not intentionally set out to find TEK in the mariner’s actions. The interviews that are not used will be discussed in the analysis portion of this dissertation.

code book.

Once coding was completed by hand and Atlas ti., the codes were transferred into an Excel document. This was done so codes could be easily moved into a word document.

The code book contains all codes that were found during the coding process, regardless of if a code was used in the final dissertation (see Appendix B). Though free nodes were broken down into tree nodes while coding by hand and Atlas.ti, the codes were revisited when they were transferred into the Excel document. During this time, specific quotes were moved to different codes in order to fit what the code was represented.

The original codes were history (personal), history (maritime), education on the water, education (another life), stories, improvisation, boat knowledge, allusions to the

water, and the maritime community. However, upon further review it was determined that they were too broad for the themes that were emerging. These broad themes were further broken down into tree nodes. These are more specific codes to describe certain behaviors or themes (Lincoln and Guba, 1985).

The free nodes and tree nodes that emerged from the coding and code book making process are described in the table below.

Table 2. Nodes	
Free Nodes	Tree Nodes
History	<ul style="list-style-type: none"> • Maritime History • Harbor History • Personal History • Stories *Also an original free node, but can be combined
Stories	<ul style="list-style-type: none"> • Harbor History • Personal History • Maritime History • History *Also an original free node, but can be combined
Experience	<ul style="list-style-type: none"> • Personal Experience • Harbor Experience • Water Experience • Boat Experience
Sense of Self	<ul style="list-style-type: none"> • Allusions to the Water • Personal Experience

The original free nodes did correspond closely with the tree nodes that were developed. However, two of the original free nodes also worked as tree nodes in other categories.

Fifth Phase

Theoretical sampling and data saturation

The data were sampled using theoretical sampling, which attempts to find patterns in data using specific data sets. This type of sampling is collecting data, through the already transcribed interviews, based on concepts or themes (Corbin and

Strauss, 2008). TEK's themes of history, education, and experience are a few that will be sought when looking through transcriptions.

Though there is no specific number of interviews that is considered appropriate for theoretical sampling, when saturation is reached interviews/transcription reviewing can be discontinued. When no new data can be found from the interview that have been collected, or the same things are being heard over and over again, saturation is reached (Corbin and Strauss, 2008). The categories that have been created through reading the transcripts (history, education, etc.) will reach a depth and variation that helps create a relationship between TEK and environmental knowledge in more developed settings. At this point, when the categories are able to explain TEK and provide an explanation of TEK, reviewing interviews were discontinued.

Data Storage

To help ensure confidentiality, each participant was assigned an interview number, which corresponded with the order he or she was interviewed in. The participant was referred to by this number in all materials pertaining to the study. This includes the digital voice files and transcriptions. All digital voice files are Ax-Crypted, which is file encryption software that can only be accessed with a password. These digital voice files are kept on a desktop computer in a locked office. This desktop computer is currently at the University of Delaware. In order to access transcripts on the computer, Ax-Crypted files were downloaded, and deleted once analysis was complete.

Each participant was also assigned an envelope with their interview materials (interview guide and notes, harbor charts) and transcripts. The envelope is marked with their interview number. These files are kept in a locked filing cabinet, within a locked

office. To better ensure confidentiality, the actual name of the participants and their corresponding number are kept in a notebook in a separate locked filing cabinet from the envelopes.

Data was also collected from various internet sources and the South Street Seaport Museum's work with boat operators involved in the evacuation. This information was included as background in the study and throughout the literature review. It may also be used to show how elements of TEK are present in the maritime industry. This data is open material, readily available on the internet and in books.

Trustworthiness

In order to ensure trustworthiness within this study, methods described by Lincoln and Guba (1985), which they employ in order for a researcher to know that "the findings of an inquiry are worth paying attention to" (Lincoln and Guba, 1985, 398). Peer debriefing and member checking (Lincoln and Guba, 1985) occurred. Peer debriefing occurred throughout the original study, in debriefings after interviews as well as meetings with the research teams from UNT and UDEL and colleagues at both universities who were experienced in evacuation behavior and sensemaking theories. Member checking took place during the interview process. This was done by probing questions, asking to clarify what had been discussed in the interview and repeating back what the interviewee had said to understand their true meaning. Also, participants were asked if there was anything that was not asked in the interview, anything about the evacuation that should be added, and questions that should be asked to other participants.

In order to better insure transferability, all interview guides will be available upon request, as well as my method for employing them being thoroughly discussed above. Other researchers are welcome to use these tools to replicate my study on different participants to ensure transferability. However, because this study is unique to mariners and emergency officials, transferability may be difficult to other populations.

Ethics

There are ethical issues attached when working with human subjects. The institutional review boards (IRB) for the University of North Texas and the University of Delaware has previously approved the interview guide and study. However, I have also obtained IRB certification specifically for this study of TEK because the original study did not name it as something that was being sought. Also, since I was on the original study and had access to participant names, IRB approval is necessary.

Participants were asked to sign an informed consent form in order to participate in the study. They also consented to the study on digital voice recorder. The signed waivers have been kept separate from the participant's information, in a locked filing cabinet in a locked office.

Conclusion

The analysis produced a narrative on TEK and how archaic technology and information can be used to benefit those in disasters. The data that has been collected from the original waterborne evacuation study and previously transcribed will be coded using grounded theory methods. To determine how the maritime community interacted with each other that day, what types of technologies or improvisation they used to

evacuate people, and how their histories, previous experiences, played a role in their participation in the evacuation.

CHAPTER 4

FINDINGS

This chapter will explore the responses of boat operators and how they pertain to TEK. In order to do this, the events of September 11, 2001, will be discussed to set the stage. Second, the interview responses that were found in the course of the original study will be provided. These responses provide the basis of finding TEK present in the maritime community of New York Harbor. Tenets of TEK, including history, stories, education, experience, utilizing a mariner perspective to define their “sense of self,” and boat and TEK use will be the basis for the foundation of this chapter to better understand the local knowledge of the boat operators. Each of these will be discussed thoroughly, using data collected from the waterborne study, including quotes gathered from interviews.

The data has shown that TEK was used extensively by the maritime community during the 9/11 evacuation. They utilized tenets of TEK to understand their environment in the fast-paced, changing world of disasters. The maritime community of New York Harbor utilized their history, education, etc. in order to successfully evacuate those stranded on Manhattan.

September 11th

Leading up to September 11, 2001, there were many signs that a terrorist attack could happen. Terroristic threats had been coming from Osama bin Laden for quite some time. The attack on the *USS Cole* as well as US Embassy bombings in Africa had shown that more attacks would come; however, they were not expected on US soil. Many red flags were raised before the September 11th attacks. For example, the

Pheonix Memo detailed some of the hijackers' learning to fly aircraft in Arizona, but not wanting to learn how to land, were either not heeded or investigated thoroughly (National Commission on Terrorist Attacks upon the United States, 2004).

On the morning of September 11, 2001, thousands of people filed into Manhattan for a regular Tuesday workday from other parts of the City as well as New Jersey, Connecticut, etc. This does not include those who already lived on the island. Terrorists boarded four separate planes that morning. Two planes left Logan International Airport in Boston, MA (American Airlines 11 and United Airlines 175), one left Newark International Airport in Newark, NJ (United Airlines 93), and one left Dulles International Airport in Dulles, VA (American Airlines 77) with a total of 19 hijackers. Both planes out of Boston were headed for the World Trade Center. At 8:47 am American Airlines Flight 11 flew into the North Tower of the World Trade Center. At 9:03 am United Airlines Flight 175 flew into the South Tower. The two flights that crashed into the World Trade Center towers had five hijackers each. The other planes were flown into the Pentagon (American Airlines Flight 77) and one crashed in Pennsylvania (United Airlines Flight 93). Not including the hijackers, 247 people were on these planes. All the hijackers had tickets for the flights, and entered the flights without being flagged. The planning for the attacks had taken years, as far back as 1996. Al-Qaeda, led by Osama Bin Laden, recruited and trained the hijackers. Those who participated in the hijackings entered the U.S. in 2000 and early 2001. They participated in airplane training in the U.S. and planned the final aspects of the attack from within the U.S. (National Commission on Terrorist Attacks upon the United States, 2004).

After the first hijacked plane hit the North Tower of the World Trade Center, many boat operators, seeing the plane hit, thought it was a Piper Cub or some other small aircraft. At that time they had not started converging on the Lower Battery area of Manhattan, which was located south of the Trade Center.

Though there were plans in place in New York City for evacuations and terrorist attacks (stemming from the 1993 bombing of the World Trade Center), these plans did not take into account that auto and train traffic would be shut down. They also did not plan for a disaster of the magnitude that was encountered on September 11, 2001. Evacuating mass numbers of people in a matter of hours, while still being concerned with safety because of other possible terrorist attacks, was not written into any emergency plan.

When the South Tower was struck, those interviewed realized, like many other people, that the plane crashes were deliberate attacks and not an accident. Seeing people in distress along the waterfront, a spontaneous armada of ferries, dinner cruise boats, private vessels and other watercraft started converging on Lower Manhattan to help. They started toward this area for three reasons. First, many people were already lining up along this area because they were escaping the attack. When the towers fell, the people evacuating the towers congregated in the area because it was the closest and safest area near the collapsing towers. Second, this area could be used by some of the boats that were responding to dock at. The Battery is the traditional point where tours for the Statue of Liberty and Ellis Island start. Therefore, there were places that ferry boats could dock to take passengers easily. Third, boats that were not able to dock in

the area, or who did not usually come to the Battery to dock went to the area because it offered the best place for mooring their boats without a dock.

Though the waterborne evacuation on September 11th was successful, having no injuries to equipment or people, it was not without its complications. The sheer number of people that had to be evacuated from off the island was astounding. Not only do millions of people call Manhattan home, but millions more commute into the city every day for work, shopping, and entertainment and that day they all had to leave the island. Traditional transportation routes such as the subways and bridges were closed. The maritime community was not incorporated into the evacuation plan for New York City and they were not formally asked to participate. Instead, they created an ad-hoc evacuation coalition to help those stranded, apart from official endeavors, to successfully evacuate around 500,000 people.

Tug boats, dinner cruise boats, and ferry boats that could not go to the regular docks were able to tie up along the railing that protected people from the water. Though the railing was not a traditional place to moor a boat, the boat operators knew they could get people over the railing and onto their vessels. The evacuation went on throughout the day. The subsequent boatlift of supplies into Ground Zero in the days that followed was one of the more successful highlights of the disaster.

Participants were asked whom they participated with on that day, if they knew them prior to the disaster, or met them that day, and if they talked face-to-face, over the phone, the radio, or through non-verbal communication. An analysis was created from these interactions to find patterns throughout the day and how relationships were formed. Knowing what technology, and what type of relationship was used that day,

provides a pattern of successful interaction. Participants relied on their voices or spray-painted bed sheets draped over the sides of boats to convey information, as opposed to VHF radio and telephone. This response supports previous research that found older technologies can work well in disasters. These are also examples of TEK often found from knowledge that was passed down or learned over the years while working in the harbor.

History

As mentioned in the literature review, TEK is centered on knowledge that is learned over time and through the “being” of a particular people. “Being” implies what makes a community of people who they are, from stories, shared history, and shared experience. This encompasses the history of a particular population. In the case of the waterborne evacuation, maritime history played an important role in how boat operators reacted on 9/11. The history that is imbedded within their culture affected not only why they evacuated, but also how they successfully carried out the evacuation. The history of the maritime industry appears to be the strongest factor in why the spontaneous evacuation took place. Why the boat operators felt obligated, and why they “did what they did” was because they see themselves as part of the maritime community, not as individuals who were witnessing a disaster.

The sense of maritime history appears to stem from the maritime ethical code that mariners live by. Though this is not an oath that is taken when one becomes a mariner, it is written down in international maritime law. Every mariner is well versed in the code because adhering to the code saves one not only the scrutiny of the maritime community, but also legal repercussions on an international scale. The code itself can

be traced back thousands of years. By the mid-thirteenth century there were well established codes of how to operate on the sea throughout Europe. This stemmed from the fact that, when trade routes were opened up, many different cultures were interacting with each other. It was necessary to establish universal codes and norms so that ships from across the world could navigate, use ports, trade, and provide support on the open sea. Hundreds of years of tradition are steeped in every mariner's conscience. Several interviewees repeated this norm:

I guess a professional time on the water. More of the instinctive stuff, just going to the boat, knowing this is down here, gets the boat out of here. Help anybody who needs some help nearby, aid to those in peril. (Boat Operator, 12, p. 27)

I think it's just human nature, you see this going on and I truly believe that maritime people, because the business is so high risk even in normal day-to-day operations on a perfect weather day, that there's always been this law of the sea that if there's someone in distress, you respond. (Boat Operator, 30, p.15)

This perspective ability appears to be learned from historical references, which make the responsibility of being a mariner something that is essential to their identity.

Mariners are obligated through the code to help those who are stranded at sea because of fire, ship failure, illness, etc. A mariner must pick up stranded passengers, help put out a fire or save lives to the extent that they do not put themselves in excessive danger. The code specifically references those that are at sea, on other vessels; it does not say that they must help that in need on land, i.e. disembark boats safely, and direct people on land to safety. How these two ideas were reconciled by the mariners is essential to why they choose to save people trapped at the lower end of the Battery on 9/11. Two examples bear this out:

It's sort of like you do what you can and as long as you're not injured and you can stand up, you stand up and help out anybody else that needs help. And that's sort of a belief; it's like an old SOS or rendering care to

someone else who needs it. And it's more than just a belief, it's a code of ethics and behavior and it was very prevalent because they were mariners. (Boat Operator, 60, p. 8)

It's a rule; you have to help a vessel in distress. You can't just go by and just let the boat burn down or go on fire. Or it's a man overboard in the water, you can't, no matter what you have six hundred or seven hundred people you have to go help him. (Boat Operator, 44, p. 17)

However, during the waterborne evacuation, people had been lining up on land to be picked up. They were not in any imminent danger of being hurt or killed, although this was not specifically known during the initial evacuation. As the day progressed, those waiting to be evacuated were just waiting to be taken home or out of the crippled city. These people in distress called to the mariners in the harbor's sense of duty to aid people in need.

When guys go out to sea, it's them and the sea and there's basically nobody else. And when you're in distress there's an obligation then to aid your fellow seamen. There's just a history of that in the maritime community that extends into the community, even within the harbor. (Boat Operator, 48, p.18)

The maritime community looks at the harbor community as part of whom they must provide rescue services to. It appears that they believe that anywhere they can see from their boats, including the shore, is within their jurisdiction and those in need should be rescued.

Maritime law, which has been passed down through generations in the maritime community, has become innate to mariners. Because of this instinct, they would be obligated to help those in peril. This idea permeates everything that the maritime community does, and affects how they go about operating, specifically during disasters.

Harbor History

This successful evacuation was not without complications. Most notably, the change the Manhattan waterfront had seen in the latter half of the 20th century greatly affected the ability of boats to dock around the island, especially the area around Battery Park City, the tip of Lower Manhattan, where the destruction was concentrated. The waterfront has changed from a working waterfront to a resident and tourist centered one throughout Manhattan. This situation is not unique to the city, port cities, and waterfront communities throughout the world have gone through this change as commerce has shifted from goods-centered trade to information trade.

The New York waterfront of the early half of the twentieth century would be unrecognizable today. Through the 1960s and 1970s the Fordist approach to manufacturing began to lose steam as land in New York City, specifically Manhattan, rose in price and a working waterfront was no longer an economic benefit to the city. During the early part of the twentieth century the Fordist model, which standardized production and made assembly lines broadly used, dominated the culture. Ports were a prime area for the Fordist model to be utilized (Norcliffe et al., 1996). They were responsible for shipping product that was coming from assembly lines in mass quantities, and had to keep up with demand. Because of this, they too began to use this functional model. Ports became very industrial and streamlined. This was specifically seen in Lower Manhattan. This area had once contained many of New York Harbor's commercial docks, but as they were moved into areas of Brooklyn and New Jersey, and the fishing industry that had moved in itself was pushed out, the area found itself in disrepair (Defilippis, 1997). "Since the area [was] only a few blocks from the Wall Street financial district, the push for office development grew as capital was branching into all

of Lower Manhattan” (Defilippis, 1997, p. 407). Though the waterfront changed, the relationships formed over decades of working together did not. These relationships are evidenced below.

This harbor is made up of all these family owned companies and there's so many old time maritime people here that work for the Port Authority, work for the steam ship agents, the Pilots. (Boat Operator, 30, p. 8)

What is being termed “waterfront revitalization” (Hoyle, 2000) is happening in many port cities. This movement is “the development of large-scale urban waterfront projects based on the creation of health and clean waterfront communities as well as specific built-form spectacles that attract tourists and investors” (Bunce & Desfor, 2007, p. 256). It is touted as redevelopment and preservation of history, but this is not necessarily true. Historical buildings that were once used for the shipping industry are still standing, but have been converted into shops and restaurants. This can be seen specifically in Lower Manhattan where a mall, park, and a museum commemorating the sea port history of the area have been created, making the area a commercialized and privately controlled space directed toward entertainment and tourism (Defilippis, 1997). This changed the landscape for those evacuating and caused them to be creative in their rescue efforts. Mariners recall the juxtaposition between the history and present harbor below.

Here's the other ferry evacuation route. This is called the shipyard. This used to be the Hoboken Shipyard. There used to be all kinds of piers back here where they used to rebuild ships. The ferry slip is right back here. (Boat Operator, 6, p. 32)

Tugboats used to tie up all through where the sea port is and all to the Battery. The tugs would tie up there and the captain would stand on the deck. They'd yell out the window in a megaphone to send the deckhand up and they'd write the guys order on it, hand it to him, and he'd go to do

his job, that was, it was kind of ironic, that, you know, they were returning to that place. (Boat Operators, 7, p. 11)

As this movement continues, fewer docks and ports have been available. “Waterfront redevelopment, in port cities and elsewhere is here to stay as a reflection of maritime technology and transport and as a feature of urban development in the late twentieth century” (Hoyle, 2000, 415). Though this redevelopment will create a waterfront that is friendly to residents, it demolishes the traditional way of life.

From a technical standpoint, the changing structure of the waterfront also hindered the waterborne evacuation for the maritime community. The Battery in Lower Manhattan had been changed from a waterfront full of piers where boats could dock to a park with walking trails. Boats coming into the Battery to rescue victims had to pull up alongside railing and tie themselves to the rails with ropes in order to get victims on their boats. This is obviously not an ideal situation to load passengers. Today in New York, they're putting in a lot of green space without the docks, which is kind of sad because I seen the funding going more towards public access to walk to the edge but not get over the edge onto a boat or a dock. (Boat Operator, 58, p. 29)

You know, it's gotten to the point now in New York Harbor where if you need a place to hang on, to just tie-up for a couple of hours, you can't do that anymore. (Boat Operator, 6, p. 22)

Some boat captains knew of piers that were closed, but were suitable for use. They went to these abandoned and neglected piers to load passengers because it was more efficient and safer than loading over the railing that lined the park in the area.

Since September 11th, some piers have been reopened and new ones have been created in Lower Manhattan, but these are very few. The area is still dominated by a park, apartments, and buildings. There are no plans to restore the waterfront to a working one.

Personal History

Closely related to maritime community history is the personal history of the boat operators. Their personal history, including family history and their life story, were integral in evacuating people and knowledge in the harbor. The knowledge that had been passed down, or acquired in the past made navigating the harbor more easily.

One respondent commented:

I said look I know people in Bayonne, I grew up in Bayonne. I know everyone there. I have a cell phone. I'll call the people. We'll drop them off there. (Boat Operator, 6, p. 10)

Boat operators were able to use their connections in the community that had developed over years to successfully evacuate people. By being able to make phone calls to acquaintances and friends, boat operators were able to drop off people that they may not have been able to if they did not have connections.

Knowledge of the harbor also allowed boat operators to be aware of their surroundings. Many of them had worked in the harbor for years, even generations, and this added to the knowledge that they had been able to gain. As an example:

So I'm fourth generation. We originally started as a lightering company. Sailboats moving cargo around the harbor of New York. (Boat Operator, 33, p. 1)

Harbor knowledge appears to have been passed down through the generations. Often, companies had been in the family for generations. The boat operator, whose family started out using sailboats to move cargo, changed their business into a tug boat company. This company was operating in the harbor on September 11th and was able to use generations of knowledge to know where to take passengers, what piers were open, and water depths throughout the harbor. As a case in point:

Being that I worked on a tugboat, we went to every pier there was. (Boat Operator, 6, p. 20)

Specifically, this boat operator was able to know what piers were open or, if the piers were closed, they knew if they were usable. Knowing if the water was deep enough to pull in a boat or if wood on a closed pier was rotted or still usable, was knowledge that was passed down through years.

Stories

One vital part of TEK is stories that are passed down across generations to a subset of a population. These stories serve as a basis for the culture, how the people react in situations, and they aid them in the decision making process when faced with situations they have not experienced before. As discussed above, the maritime industry has a rich history of stories that affect how mariners operate. For instance, mariners have passed down stories about mermaids and phantom ships. This history can be fanciful at times, but has a basis in reality to warn or protect mariners at sea.

Stories served an important part in the evacuation effort for mariners in New York harbor. The most important story that was referenced by mariners was that of Dunkirk in World War II. During the evacuation of Dunkirk, over 300,000 Allied soldiers were evacuated from the beaches of France while the Germans were closing in on them. Not just military boats participated (Lord, 1982). Commercial and personal boat operators participated in picking up soldiers stranded on land, much like what those in New York Harbor did on 9/11.

The mariners on 9/11 thought of Dunkirk when they were proceeding to evacuate from the sea wall in the Lower Battery:

To my knowledge, it was unprecedented. Other than maybe Dunkirk, where the tugs came over and got the British army off before the Wehrmacht came and

destroyed them and got them back to England. (Boat Operator, Interview 55, p.11)

9/11 was like, it was like Dunkirk. (Boat Operator, Interview 6, p. 30)

The allusion to Dunkirk was a very interesting aspect of the interviews. The mass evacuation resonated with the maritime community, even though the incident happened halfway around the world, decades earlier. They associated themselves with the maritime community that participated in this event. First, they knew that an evacuation could take place with ad-hoc vessels (tug boats, yachts, etc.). Second, the Dunkirk rescue created a precedent to be followed by mariners. The rescue was that of people stranded on land, not at sea, yet they were still rescued as if they were in danger on the sea. The deeper sense of being a mariner, and having an obligation to save those that could not save themselves came out in this sense, as it did in New York Harbor. As one boat operator put it:

(The) overriding principle of you do what you can, you stand up and you try to help out. And that is a principle of the maritime industry and it permeated every decision (that was made that day). (60, p. 19)

Boat operators also took stories from movies and knowledge passed down through generations to understand what was happening that day:

Look at it, it looks like, to put it into perspective, you've seen movies where a bomb goes off in a city or you know, some of those World War II films. It, it looked like that. (Boat Operator, 39, p. 14)

In order to understand their environment they had to draw on their experiences from somewhere and movies were a source of history of war that they could use if they had not personally experienced war. This allusion to war also led them to the belief that those stranded on the shore were in imminent danger.

Education (On the Job Training)

A non-traditional education, or learning within the environment, appears to be a key facet of the maritime community as well as a vital tenet of TEK. Mariners appear to acquire a vast amount of knowledge working on the water. This education is compiled over time, experiences, and interaction with more seasoned mariners. The community itself is vital to nurturing and grooming new mariners since each harbor is different and has its own nuances that must be learned through experience.

Many boat operators had spent their entire careers working in New York Harbor:

I've been working in New York Harbor since I've been 17 and I scoured the waterfront. I studied the charts. What can you do, what they do here, what they don't do here. What kind of boat can go in here, what kind of boat can't go in here. (Boat Operator, 6, p. 20)

What working in this harbor for a career allows them is the ability to know all aspects of the harbor, from the depths of the water to what piers can/cannot be used.

The harbor charts that are mentioned by the boat operator are vital to the knowledge of the maritime community. Though these are written documents that are not "passed-down" they are part of a larger, ancient custom of charts within the maritime community. These charts are as old as the harbor is, though they do change to reflect new buoys, docks, closed docks, etc. Therefore, the knowledge that these charts contain is passed down knowledge, as well as knowledge added on as new information is learned. This is the epitome of using TEK in a developed nation's context and expanding on the theory. The chart's knowledge is changing, and the knowledge added updates the community to the most recent structure of the harbor.

Education on the water is key for one particular group of mariners in the harbor. The pilots, which can be found in major harbors, are a group of mariners who dedicate themselves to knowing every aspect of their specific harbor. They board large ships that

enter their harbors and guide them through the harbor. This is because the ship's captain may not be familiar with the harbor, its depths, tides, etc. Pilots are specialized in these areas. One respondent stated:

And the reason I opted for the pilot base, the reason I opted for the New York was recognizing that Sandy Hook pilots bring a lot of knowledge. A Sandy Hooker does have knowledge for these guys. They do a 14 year apprenticeship before they are a pilot. (Boat Operator, 40, p. 5)

Pilots complete a 14 year apprenticeship, at the end of which, they must draw, from memory, a chart of the harbor including depths, buoys, docks, tides, etc. This is no small undertaking and at the end of the 14 years the Pilot is as well versed in the harbor workings as anyone could be. All the knowledge is learned, on the job, working within the harbor. Knowledge is directly passed down from one Pilot to another.

. The knowledge that has been accumulated over hundreds of years of working in the harbor is passed down to apprentices. Stories of ancestors working in the harbor, and their learned knowledge is all accumulated in the education a pilot receives on the water.

Being on a boat, the crew is the fireman, medic, cook, and captain. If something goes wrong on the vessel, they are responsible for their boat and, ultimately, their lives. In the middle of the ocean, though they can call for "Mayday", there is no guarantee help will arrive in time. Experience working on boats has taught mariners that they must be able to rely on themselves to solve problems:

In the maritime industry, if there's a collision, keep in mind, that there is no fire department, you're it. Man overboard, you're it. Whatever the disaster, you're it until somebody can come to your rescue. (Boat Operator, 8, p. 7)

You learn that operating if there's an emergency, a man overboard or a fire on a vessel, you use your knowledge. (Boat Operator, 58, p. 17)

Being able to put out fires, perform basic CPR, and perform general emergency operations is essential to any crew. This is something that new crew members learn very quickly on the water, if they are not already familiar. Because of this, mariners are able to handle situations that they may not normally encounter.

I think the average mariner was ten times more prepared for any kind of emergency than the average office employee. (Boat Operator, 33b, p. 33)

By being prepared for small incidents on the boats, mariners were able to assess the situation on September 11th and put the education they had received on the water to use.

Overall, the education that a mariner receives on the water is invaluable to being able to operate within the harbor. Through years of learning, they can apply their vast knowledge, and that passed down to them, to emerging situations.

Experience

Personal experience from the mariners was an important factor when choosing to evacuate. This led to a successful evacuation. The experiences that boat operators had in the harbor prior to the disaster gave them valuable information that they could call on to successfully evacuate victims.

The experience led to a sense of camaraderie between the mariners that allowed them to work together, even if they had never met face-to-face. Mariners had worked with each other over the radio (the open harbor channel was 13 where they could talk to each other daily), in harbor emergency exercises, and professionally (working for different companies throughout the harbor).

Now the reason there was such a sense of camaraderie is because there's people had worked together for years. (Boat Operator, 60, 19)

We know everybody. See, over here is a pretty close-knit thing. (Boat Operator, 23, 14)

And again that's, that comes down to all of us knowing each other. (Boat Operator, 42, 15)

Even if the mariners had never met face-to-face, they knew each other's names and voices because they spoke regularly on the harbor radio. This is daily used for communicating directions when passing each other, or information about problems in the harbor. On September 11th, the radio was used to communicate similar ideas. The mariners would tell each other where to pick up victims and where they were pulling in, so that no crashes occurred.

There were disaster exercises held in the harbor and mandatory Coast Guard training. This preparation did not necessarily give evacuation preparation information. However, it did allow the community to work together to learn problem solving techniques. It also brought people together who had not previously known each other. This led to a closer knit community in the wake of the disaster.

They also used their prior disaster experience in the harbor to aid in evacuation. The 1993 bombing of the World Trade Center affected how some made the decision to evacuate people stranded on the Battery.

There was prior experience form 8 years ago. But it was pretty much the same kind of response. If there're distressed people on the seawall, the ferry boat people go and pick them up. (Boat Operator, 25, 14)

We've learned from our experience in the past, we were involved in the 93 evacuation previously. (Boat Operator, 57, 2)

The experience from the '93 bombing allowed boat operators to gather knowledge about evacuating disaster victims (specifically from Lower Manhattan) that they did not know prior to the bombing. This knowledge, though it was only eight years old at the

time, was vital to the success of the evacuation. Experiences do not need to come from decades of experience, they can be from one or few instances that cause a change in behavior and cause people to learn from the experience.

Harbor Experience

Not only was experience integral in the boat operator's ability to know one another, it was also imperative to the boat operators' ability to navigate the harbor. Years of experience working in the area had allowed them to understand all of the aspects of the harbor.

Knowing the vessels in them, only the crews or capabilities, knowing that we could carry passengers or knowing that we could accommodate logistics support and put stuff on deck, I think that it helped a lot, and just years of experience in the water and working and knowing the geographical familiarity of the port of New York. (Boat Operator, 39, 27)

By knowing the "lay of the land" so to speak, or the geography of the port, the knowledge of the harbor was helpful for the boat operators on September 11th, though on land there was uncertainty and a changing landscape. Most notably, the lower end of Manhattan was turned into rubble but the water was the same as it had been the day before. Because of this, the mariners were able to put their knowledge of the harbor to use and evacuations were more successful because of it. For instance,

One of the keys of what took place there is the knowledge of what we call in the marine field "local knowledge", of where to go. You just can't drop them off at a certain pier that you know has barbed wire gates with dogs on the other side of it. (Boat Operator, 8, 12)

The knowledge that piers in the harbor were opened or closed was vital to evacuations that day. Boat operators were inundated with victims on their boats. They did not have a chance to go to different locations trying to find places where they could embark and

disembark. Instead, they needed to use the knowledge they already had to make the best decisions at the time.

Water Experience

Knowledge of the water, when tides came and went, and the depths of the water in the harbor, was brought about by experience of working in the harbor. Though the participants, when asked specifically about how they knew where to go, acted as if the knowledge that they acquired was something that would be easily known by anyone, the information about the harbor is very detailed.

One boat operator explained that it was knowledge that was specific to the maritime community of New York harbor that gave them the ability to understand the tides and where to tie up boats.

Now this is where any mariner that's a captain or above responsibility mode, in New York, should have inherent knowledge of the fact that tidal range is gonna greatly affect your decision of where to embark and disembark passengers. (Boat Operator, 17, 8)

It was expected that mariners in charge of ships knew the harbor and how it could affect them, whether or not they were part of the Pilot Association. Understanding how the water affects a vessel was imperative to the success of the evacuation.

I believe it was almost high tide when we started out, so everything was - you know, - everything was pretty even as far as in the boats, the people on the boats and the dock. Course, we did it in a course of like 6 1/2 hours so, you know, at that time the tide had changed and everything so we had to make some changes in getting people on and off the docks. (Boat Operator, 24, 6)

The maritime community knows their boats and how the water affects their boats' abilities. Instead of working against the water, they realize they must work with the water.

I know where the currents are swifter and if you have a heavy parallel current you want to be able to nose your boat into the current, things like that. (Boat Operator, 35, 13)

Knowing how the water current was running allowed the boat operators to nose their boats into areas, such as the Lower Battery, to pick up passengers. Though they may not have normally used park railings to tie up, boats were able to do just that because of their prior experience.

Boat Experience

Boat operators had been gaining experience in the harbor much of their lives. Many talked about how they had worked or had experience on boats since they were children.

I just know how to run a boat. We've been on boats since we were kids. We were on fishing boats. (Boat Operator, 27, 61)

Yeah, I grew up on sailboats. We had a 1931 164-foot heavy motor yacht, that's how we found out about the pier. (Boat Operator, 16, 20)

Growing up on boats allowed the boat operators to understand what different boats could do. Just as someone who has grown-up around horses and knows how to handle them, these mariners knew how to handle boats. Understanding the boats was imperative to the success of the day because maneuvering a tug, ferry, or small power boat under normal circumstances can be difficult. It takes a large amount of skill to maneuver the vessels through harbor traffic and not have an accident under pressure and stress, which was the case on September 11th.

Understanding their vessels also allowed them to use the vessels in ways that are not traditional. For instance, tug boats do not normally carry passengers. They also do not normally embark and disembark passengers from the bow of the boat.

I mean, the riskiest thing we did was boarding people in a seawall that wasn't equipped for it. The railings you had to go over. You didn't have time, but you try to be selective as to where you would go. That's why we were at North Cove. It had a lower dock. (Boat Operator, 58, 18)

However, loading from the front of the boat was the only way some tugs could get into the sea wall along the Lower Battery. Tug boat captains knew they could nose their bows in and have people crawl over the side because they knew their boat could load from the front and they knew the tide was high enough to load people easily onto the boat.

We had an advantage, we knew, as local mariners; we knew what boats like the Miriam Moran. We pretty much knew how big it was, where it could go, where it couldn't go. (Boat Operator, 6, 14)

A nuanced knowledge of their boats also allowed boat operators the ability to overload their vessels without fear of capsizing or losing passengers overboard.

I definitely overloaded the people (on boats). (Boat Operator, 29, 10)

The boat operators knew when to stop overloading the boats by their experiences of working with boats throughout their lifetimes. They understood that, though the boats may have had an official capacity, they could hold more passengers. However, they kept the boats safe and to a capacity they knew was manageable because they did not want to have another disaster on their hands by a boat capsizing.

He'd say 200, all right, keep up, keep going. You saw so many people waiting to get on. He didn't want to say ok, only put 220. So we put on 250, we put on 300 and said, okay, that's enough. You didn't want to put like 600 on it or you'll have people turning the boat over. (Boat Operator, 61, 20)

I mean, we were supposed to put 80 passengers; we were putting about 90-95. You know, we were going 10-15 maybe 20 people over the limit, but I kept basically everybody on the lower deck for the stability and I knew it, everybody, I know what I was doing. (Boat Operator, 37, 13)

Putting people on the lower decks and over loading the boat by a certain number of people, which was the amount they knew would be safe, shows that the boat operators had experience with their boats. Though they may never have deliberately over loaded the boats before, knowing a vessel's capabilities was imperative to their everyday existence.

As was discussed previously, a boat operator had to know their boat and adapt to the changing situations on the water in order to survive. This is because if they are on the water, they can only depend on themselves. This same sentiment can be found when over loading boats. Depending on themselves, and knowing that they would have to save themselves if a boat capsized, kept the boat operators overloading boats to the point they knew was safe.

In fact, the boat operators did not mind that they knew they were breaking the law:

I mean, a tugboat is only certified for probably a dozen people? I mean, you got 200 of em on there. (Boat Operator, 2, 33)

Deliberately breaking the law, which many did and openly admitted to by overloading passengers past Coast Guard specifications, is particularly interesting because the pilots and boat captains were so adamant about not breaking Maritime Code. It does not appear that they pick and choose the laws they want to follow. Instead, their code superseded all laws that contradicted it. Though Maritime Code and laws were normally not at odds with each other, on this day they were. Being a mariner trumped being anything else and led one participant to echo the sentiment of many others:

In our industry, you know, you do what you have to do. You do what needs to be done. (Boat Operator, 47, 17)

Sense of Self

Aspects of the water appear to be ingrained within the psyche of the mariners in New York Harbor. This is not shocking, considering the position that they took when rescuing people trapped on the shore in Manhattan. However, being a “mariner” goes beyond being indoctrinated into the community. Instead, they appear to live and breathe being a mariner and “on the water” at all times during their lives.

Interviewees alluded to occurrences that did not directly relate to the water as if they were part of the maritime culture. For instance, when describing the massive crowds one interviewee said:

We either were going out into the sea of people that was streaming south and I don't think you could even get out of either door before you'd be swept by them.
(Boat Operator, 25, 8)

The interviewee was not speaking of boats or even people lining up along the Lower Battery. He was speaking about the crowds of people that were streaming through Manhattan away from the Trade Center. Choosing to describe the crowd as a “sea” of people speaks to the idea that mariners are mariners whether on water or on land. They look at the world differently than those people on land. They almost appear to be programmed to associate everything with the water.

Another interviewee believed the wave of people fleeing Ground Zero:

Looked like a tidal wave coming at you. (Boat Operator, 33, 6)

Though this term, and the previous one, may be figures of speech, there is a much deeper, ingrained meaning to the maritime community in using this type of language. By looking at people or instances through a “mariner’s lens”, the view of the water is brought into everything.

Boat operators also compared people waiting on the shore to ferries overcrowded with people:

It looked like one of those Haitian ferries, overcrowded with people. (Boat Operator, 2, 29)

Even when people are not on boats, boat operators look at people as if they are passengers. When seeing the people overcrowded on the shore, they thought it was imperative to rescue them.

If the maritime community believes they are always “on the water” and identify themselves as mariners first and foremost, then they will also feel obligated to act as if they are on the water at all times. Namely, they will follow the mariner’s code discussed above. The sense of culture that has been passed down through the generations has enabled the maritime community to use their boat skills (safety/rescue, improvisation, etc.) on land or transpose them to everyday situations.

Boat Operators and TEK

Though the original study did not set out to find if TEK was used by boat operators, there was enough evidence within their narratives that made it apparent it was present. The examples provided give an insight into the way the maritime community thinks and acts, almost as one “wave” when rescuing people in peril is involved. They use their knowledge from the history of the community as well personal education and experience to successfully navigate the choppy waters of evacuating over 500,000 people successfully.

The information found during the original interviews that has been discussed in this chapter has found elements of TEK being used by the maritime community. Elements of TEK, including: history, stories, education, experience, and a sense of self

(being a mariner), were found in the interviews. The following chapter will discuss how TEK can be utilized in a broader context in developed nations.

CHAPTER 5

ANALYSIS

The purpose of this dissertation was to find aspects of TEK in the maritime community that were used in the evacuation of Lower Manhattan on 9/11 when over half a million people were evacuated successfully without the help of a pre-existing plan or a direct connection to city officials who would have been involved in the official evacuation. The successful evacuation on 9/11 was directly related to the maritime community's ability to utilize their history and education to know where, how, and when to evacuate the population.

The study provides preliminary evidence that TEK may be effective in developed nations for disaster response/preparedness. This chapter will discuss the implications of TEK in a broader context. First, it will do this by discussing the implications TEK has for theory and research. A discussion of how TEK has been used in prior theoretical perspectives and how the current study expands on the past literature that focused on developing nations will take place. Second, the implications for practical applications will be explored. This includes how TEK elements which were found during the course of the study (history, experience, and education) can be applied to developed nations' evacuation processes and how to go about doing so. Third, expanding on the information gained from the study, implications for public policy will be presented. The current system of using the incident command system (ICS) to respond to disasters does not necessarily incorporate local knowledge. Therefore, a hybrid of this system and principles of TEK will be discussed as one way to combat the problems with ICS.

The Use of TEK on 9/11 and Its Implications

This study offers an opportunity to further explain and expand the theory of TEK which, as evidenced by the literature review, is in need of more research. The uniqueness of this study can be found in the fact that there have been comparatively few studies that integrate TEK and disasters in developed nations (Iturrizaga, 1997; McAdoo et al., 2008). This leaves the research field fairly open to studying new forms of TEK and developing uses for it in developed nations.

This study illustrates that the mariners who conducted the waterborne evacuation were the epitome of the appearance of TEK in developed nations. The previous chapter provided examples of how the mariners used their knowledge of the harbor and maritime history to navigate and manage the disaster. Their example shows researchers and practitioners that the theory can be applied to those who are not traditionally thought to use TEK. Instead of TEK being relegated to developing nations' farming practices, the maritime community in the United States put their knowledge of the harbor to use when knowing how to and where to evacuate victims from New York City. The boat operators in New York Harbor understood what piers were open (even if they were "closed" on paper) in order to take evacuees to safety out of Manhattan. Because of this, insight into the environment, both natural and built, can be gained and utilized when applying the theory in non-traditional contexts.

Utilizing TEK in developed nations and understanding that indigenous concepts such as history, stories, and education are not specific to underdeveloped nations can be a primary research topic for those who study TEK as well as disaster researchers.

Then, these can be expanded upon to find other, unknown tenets of TEK, instances where it is best used in developed societies, and the role that technology and modern emergency management practices have on the success of TEK. Once TEK is discovered in developed nations (and is not just a unique concept to developing, indigenous people), it is imperative to stretch TEK further. One such research topic that should be studied is how technology and other advances that a society has developed can work with or affect TEK practices. The indigenous knowledge that is within a developed society needs to, and cannot be separated from, the technology and advances of a society. Therefore, understanding how TEK has developed within developed nations, beyond traditional farming practices, should be explored. Questions such as: “How does “indigenous” need to be defined/re-defined for developed nations?” “What does TEK look like in the 21st century?” and “What new forms of TEK or terminology come about from studying TEK in developed nations?” should be asked by researchers in order to understand the changes developed nations make to *TEK*

TEK should also be expanded to incorporate the 21st century and the technology that is associated with this time period (cell phones, internet, GIS). The current application of TEK principles does not account for these technological advances and what have become common-place items in a developed environment. Instead, it is based on older technologies which are not necessarily relevant to a developed society. The research on TEK and its effect on developed nations can be furthered by incorporating the aspects of specific cultures into the research on those cultures.

TEK: Redefining Indigenous

This study has pointed to an important task: redefining the concept of “indigenous.” The definition of “indigenous” needs to be expanded in order to encompass those who have developed new knowledge in their native areas (i.e. New York Harbor). Indigenous (traditional) knowledge is not relegated to small, indigenous people in remote areas of the world. Instead, looking around, there is tradition and knowledge in all cultures across the globe. Researchers have focused too much on developing countries to apply TEK. In order for the theory to grow and expand, it must be thought of in broader terms. TEK must be expanded and stretched in order for it to be relevant to today’s fast-paced, globalization prone world. Though the original concept of TEK can be used in this new, expanded form, it may not be recognizable to those who are familiar with the traditional form of TEK.

However, those who are living in developed nations must work with the natural and built environments. Not only do people living in developed societies need to worry about weather and natural situations, they must also contend with vulnerabilities in roads, buildings, technological advances, and, as in the instance of the waterborne evacuation, with the possibility of terrorist attacks. One imperative way to improve and grow TEK is to recognize that indigenous people can be found in many different places, not just in remote areas of developing nations. The changes in the waterfront of New York Harbor; the closing of many piers, ferry operations, and the evolution of the “working” waterfront into a pedestrian area, were all technological and societal developments that the boat operators had to contend with during the waterborne evacuation. The study of the evacuation of 9/11 has shown that there is a need for

scholars to study TEK in developed nations. Specifically, pertaining to disasters, there has been a lack of study when looking at the use on TEK in developed nations. By including developed nations into the research of TEK, the concept can be developed into a well rounded one that can be applied to many different societies. Why have developed nations been largely ignored when studying disasters and TEK? How does the natural and built environment interact with disasters in developed nations? What does “indigenous” look like in developed nations?

There is also a need for researchers to develop new terminology to cover TEK in developed nations. Land use management is not the only way to apply aspects of TEK. Instead, the “new” indigenous need to incorporate language that is native to the area that is being studied, even if that area is a developed nation. Just as the language of the maritime community was vital to the success of the evacuation, by understanding the language of the mariners in order to navigate the harbor, so is the language of other communities. This does not need to be farming language from traditional people. Instead, the language that TEK uses should be descriptive of the environment that is being studied.

Though more aspects of TEK could be found in the study of the maritime evacuation on 9/11, there are certainly other instances of TEK that can be found on 9/11 and other disasters (Hurricane Katrina, Tohoku earthquake and tsunami, BP oil spill, etc.). The questions that need to be asked in future studies are: What roles do technology and emergency management practices have to the success of TEK, and What are “new” tenets of TEK unique to developed societies? Together, future studies

will expand TEK to be used in more disciplines than anthropology and allow the use of it to be more all-encompassing of developed nations.

Implication for Practical Applications

There are implications for emergency managers' approaches to preparing for and responding to disasters. These implications can be found in the history, education, and stories that were presented in the previous chapter. These elements of TEK can be used on a practical level and be incorporated into emergency management operations in order to harness the best parts of TEK for the benefit of a developed nation.

Harnessing History for Emergency Management

Utilizing the traditional definition of TEK, local emergency managers can use historical references and stories to plan for, respond to, and recover from disasters. Specifically, they can use history to know what routes used to evacuate people or where flooding traditionally happens in an area. Though many western cultures have abandoned TEK, and the history it holds, in favor of technological advances, combining the two aspects can be helpful to local emergency managers (Bankoff, 2004). The emergency management community can use TEK in conjunction with technology. The boat operators used their knowledge of the harbor to navigate their boats while also using technology such as VHF and modern boat equipment.

Emergency managers have been encouraged to look to history when planning for disaster mitigation and response; however, they do not always do this. For instance, communities like New Orleans do not always look to their history when planning or building. Instead, the city built in many areas that were prone to flooding. The French

populated areas like the French Quarter, were above sea level and spared much of the destruction caused by Hurricane Katarina.

A similar example is mentioned from Oliver-Smith (1991) in which the pre-Spanish settlements of the Andes in Peru utilized ancient practices to develop settlements. After the Spanish came to the area, they abandoned practices such as dispersing settlements and utilizing natural building materials. Not only did the Spanish change the building material used, they also added more floors to the structures. Where the structures had once been single story, the Spanish built multiple story structures. When an earthquake hit in 1970, the multiple stories collapsed (made of heavier material) and caused more death and destruction than had been seen with the traditional buildings.

Also, the Spanish changed the farming practices in the area. Instead of traditional terrace farming, where steps are cut into sloped land to grow crops in order to reduce run-off and enhance irrigation, the Spanish introduced European farming techniques (Oliver-Smith, 1991). European techniques involved using farming practices where land was farmed flat, without the use of terracing. Though the Spanish thought to abandon the ancient practices in favor of larger settlements in riskier places (nearer mountains) they were not successful. Instead, these settlements and practices led to large amounts of destruction, as was evidenced in the 1970 earthquake (Oliver-Smith, 1991).

By using local history, the planning process can be enhanced. A community can plan for where flood waters will go based on previous experience. The “lessons learned” from previous disasters can prove invaluable when attempting to predict what may

happen in an extreme event. However, relying solely on the past experiences to prepare for the future can be problematic. For instance, the emergency managers of New York City found that the maritime community would be available, successful, and willing to participate in an evacuation after 9/11 or in the future. However, the planners chose not to involve the maritime community in the later disaster planning process. The maritime community itself found that more ferry operations in the city would be beneficial and popular to communities, which saw the value of the water during the evacuation.

Terrorist events are not the only problem facing New York City. Hurricanes could hit the island and would often cause flooding in the subway systems, thus leading to the need for boats to carry people. However, as was thoroughly discussed by the boat operators in the study, the harbor had physically changed over time. Docks had been lost since it was no longer a working waterfront. Instead, the waterfront had been built up with jogging trails and photo friendly scenery. Knowing this was vital to the boat operators being able to successfully evacuate the residents and workers on this island. They knew what the past held for the harbor, they also knew how it had changed over time, and what help it could offer them on that day. It is imperative that the people who are planning for disaster response and recovery know what their past is, and what their present and future are, in order to navigate a disaster successfully. It is important to incorporate “lessons learned” while not ignoring the cumulative knowledge that has been acquired from disasters, research, etc.

The history of an area can be harnessed in different ways. First, emergency managers can consult old news stories or historical documents to know what types of disasters were faced in the past. This is one way to know more in depth what types of

weather patterns an area encountered. History can also provide knowledge about what the population in a community. If, in a past disaster, the community found they had a difficult time evacuating their large elderly population, then the present emergency manager could better prepare for the elderly population.

Second, community members can be consulted to get a first-hand experience of what a particular disaster was like. Similar to the waterborne study, first-hand experience in a disaster can provide an emergency manager essentially a list of what worked and what did not. This first-hand experience can then be translated into specific evacuation routes, utilizing a subset of the population to perform evacuations. Specifically, the boat operators involved in the waterborne evacuation had extensive knowledge of the harbor that translated into knowing how to evacuate people. Firsthand knowledge can also be used to know what problems might arise (road closures or landslides) when a disaster strikes.

“Unfolding” History

Every day we add to our knowledge base about our environment. Disasters provide ample knowledge, which are often compiled into a “lessons learned” after a disaster. These lessons are compiled post disaster in order to learn from the past, so that mistakes can be corrected before the next disaster and successes can be repeated. Unlike history that has been passed down over time, this section discusses the history that is created every day, and the lessons which are learned after a disaster. In this sense, “new” knowledge is created during and after a disaster and should be utilized just as knowledge that is passed down from centuries.

Harnessing history that is created by previous disasters, such as the World Trade Center Attack, is imperative to incorporating “new” history into a culture’s psyche. This new history can be from knowing what types of disasters to expect (terrorist attacks) or learning better ways of evacuating populations (by boat) that were not known before a disaster, but become more common knowledge after a disaster. Disaster planners can use not only their “lessons learned” post-disaster, but their “lessons learned” from history to understand the environment they are living in. Just as 9/11 opened our eyes to new hazard-hijacked planes as weapons, the successful evacuation provided new ways to perform a routine disaster function-evacuation. As history changes, so should the information that people have and use to make decisions.

Also, by incorporating ideas that have been found in recent history into disaster planning, responding to disasters will allow for a holistic approach to disaster evacuations and response. This approach will combine local knowledge new technologies and ideas. Looking at these changes as history in the making, and adding that history to disaster planning initiatives will enhance evacuation techniques.

Beyond Harbor Charts: Utilizing Technology and TEK

Local knowledge that is created in developed nations may appear different from that of developing nations and traditional forms of TEK. Instead of living in an environment where stories may have told you that particular seasons, wind direction, or animal behavior indicates a tornado or a tsunami, new stories can be passed down in developed nations that tell people who the most reliable weathermen are, or what the best roads to take during heavy rains.

The stories that may be told to developed nations may be over the television or internet, making them appear different than traditional forms of TEK. For instance, though developing countries have boats and harbors they do not have the same built environment that was present in New York. In New York Harbor, the shore has specific points of entry/egress for ferries as well as railing for walking trails along the shore. However, New York Harbor is a large, technologically advanced harbor which uses high-tech boats, radar, and communication equipment to navigate the water. The abundance of ferry and tug boat companies that are utilized by commuters and businesses daily in the harbor greatly added to the success of the evacuation.

Large harbors, typically situated in developed nations, have these same resources. The knowledge that is brought about through working and living in these harbors is unique to the area. They create local knowledge which may not have been present in the first conceptions of TEK, but are vital to the expansion of the theory into developed nations.

It must be noted that an over-emphasis must not be put on history in developed nations. With societies in these nations being very mobile, not necessarily living in the place that they or their ancestors lived in, people could be lacking TEK. If someone is new to an area, they may not know what an emergency siren signifies or what areas of a city flood. Though a flood plain map may give this information, it would not be able to paint the same picture as years of knowledge would. Knowledge would develop over time by living in an area, but it would take time to build this up for the mobile society that is in developed nations.

After expanding traditional knowledge and what it means to be indigenous to an area, TEK can be furthered by utilizing technology, which can be commonplace to indigenous people of developed nations. Technological advances, such as cell phones, Doppler radar, and Geographical Information Systems (GIS) have expanded the knowledge of an area to include technological advances which are common place in a developed nation. In fact, technology itself can be knowledge acquired by a society. For instance, by living in today's developed society, people have come to rely on everyday technologies, such as radio and cell phones. These technologies have become commonplace for people living in developed nations to communicate effectively .The boat operators utilized VHF radio and cell phones in order to communicate. However, the radio was often too crowded to talk on and get information from on 9/11. Though technology is beneficial, it is not always possible to rely solely on it. Technology has lent itself to a new kind of knowledge that developed societies have acquired.

Because of this technological boom, however, knowledge that was once considered commonplace may be lost in the future. For example, people may not know how to read a paper map or follow directions without a blinking blue arrow to show them the way. However, when technology fails, the need for indigenous technologies becomes apparent. During the waterborne evacuation communications using the VHF radios was difficult to impossible to use. Therefore, using other forms of communication became necessary. The boat operators hung sheets outside of their vessel to communicate where they were going and used megaphones to give orders.. Communities, such as the maritime community, still see the need for the older way of doing things and keep their community informed of this. This should also be done for

many other communities in order to better prepare for disasters. By learning from the maritime community, the current technology can be harnessed while keeping the past in mind.

Current Approach to Disaster Response

There are aspects of the findings of this study that can have profound implications for public policy. Currently, public policy centers on the use of a command and control model, in the form of the incident command system (ICS), to prepare and respond to disasters. This system has had difficulties incorporating ad-hoc groups and traditional knowledge in response to disasters. Specifically, groups such as the maritime community in New York Harbor have been rarely incorporated into ICS. The following section will discuss the current system and the changes that can be made to the system utilizing TEK as a form of adaptive governance, which can harness local knowledge missing in the current system.

Currently, the incident command system (ICS) has been introduced as the bureaucratic mechanism that will hold multiple agencies (public, non-profit, and private) together during a disaster. This system has been applied to aspects of disaster preparation and response, and is currently federally mandated for any organization that provides disaster services. During planning and response phases of a disaster, the system is implemented and organizations must fit into ICS in order to participate in the disaster response. If they have not been identified prior to a disaster, it is difficult for an organization to be included in the process. ICS creates a strict, hierarchical structure, which is also supposed to provide many facets of the network structure created in the hollow state. These include collaboration and coordination, while still operating under a

strict command and control structure. During the September 11th evacuation, ICS was in place to evacuate victims from the World Trade Center buildings before they collapsed. However, the system did not immediately include the maritime community after the strikes and the participants of the waterborne evacuation did not utilize the system to coordinate the evacuation.

ICS's supporters claim that the system is flexible, and can expand and contract according to the size of the incident, how many organizations are involved, and how many participants are involved (Cole et al., 2000; Perry, 2003; Bigley and Roberts, 2001). However, opponents of the ICS structure find that the rigid structure that it operates under can be a hindrance to outside agencies that do not know the system and do not use it on a daily basis (Buck et al., 2006). These agencies, including non-profits and private entities, are left out of the system. This occurs not because they do not have valuable resources, but because they do not know who to talk to or where to go so they can provide those resources.

Aspects of TEK are not integrated into ICS. Instead, local knowledge appears to be ignored in favor of a hierarchical bureaucratic structure. The lack of use of ICS by the boat operators on 9/11, even though they were trained in the system, speaks to its inability to reach organizations that do not typically operate under a command and control structure, such as relief, welfare and other agencies. The boat operators did not use ICS because they were not included into the ICS system when it was set up during the evacuation. In fact, the system was not put into place until the majority of evacuations were completed. Also, the boat operators did not feel that it was the best system to use during the evacuation. Instead, they relied on their pre-existing

relationships to create an environment which was conducive to successful evacuation. For instance, the boat operators directing the boats in the harbor (those stationed on land) knew what each boat in the harbor could do (number of people they could carry, their boats' capabilities, etc.) based on their daily operations and interactions in the harbor. During the waterborne evacuation it was not prudent to use the system at all. The waterborne community did not have time to consult the cities shoreside (who were not present during the first half of the evacuation) to create an ICS. They relied on their previous relationships to come up with a system that worked best for them: working together as individuals without a pre-set plan to evacuate victims.

Informal relationships have appeared to provide vital success in disasters. These relationships often come in the form of previous, existing relationships, which have been able to foster communication and cooperation on an informal level prior to disasters (Buck et al., 2006; Kapucu, 2006; Waugh & Streib, 2006; Agranoff & McGuire, 2003). Informal relationships are also a vital part of TEK. Relationships, stories, history that has been passed down, etc. are all formed and shaped by rapports that are developed over time. Also, it is the "informal" relationship with the environment that allows local knowledge to grow and gain more knowledge over time. Watching the environment, and learning from its cues, creates an informal learning environment for local knowledge. By having these relationships in place, those preparing for disasters know what and who to call on in time of a disaster. These relationships are not necessarily mandated by the government, and do not require legislation to carry out. By working together to solve large issues that are often seen in disasters, government would be better prepared for disaster.

TEK is in direct correlation with adaptive governance, or networking, approaches taken with many types of contracting out situations. However, the system does try to account for the fundamental differences in providing services from a government and from an outside agency. Coordination and collaboration are tenets specified in the ICS, yet, they are often afterthoughts within the system, with command and control aspect taking center stage.

TEK as Adaptive Governance

In order for response systems to bring in local knowledge, those with local knowledge (the boat operators who participated in the waterborne evacuation on 9/11) should be included in the planning and operations aspects of emergency management. This way, local knowledge is utilized before a disaster for land use planning, evacuation route planning, etc. so that there is not as much of an ad-hoc nature when a disaster strikes. By expanding the limits of their imagination, those running ICS can find who would best serve them to give a comprehensive overview of what types of local knowledge an area has. The specialized knowledge that local knowledge experts can bring is just as important as others that have been previously involved in the planning and operations processes (fire, public works, non-profit aid workers, etc.) Public policy should look at more than one way to approach disaster preparedness and response and take the best aspects of those ways and integrate them into a holistic system.

The failure to utilize ICS and, instead, rely on history, education and experience, along with relationships that were formed through living and working in the environment of New York Harbor, have brought to light that the current system for approaching disasters may not be as useful as utilizing preexisting relationships. The “sense of self”

that the maritime community had when evacuating victims was more strongly linked to the water than to a pre-existing system of ICS. For instance, the boat operators identified themselves as part of the maritime community, not that of the disaster rescue operations. In the previous chapter quotes from the boat operators expressed the sense that they identified with the water and how that identity (believing their rescue ethos extended to those on land) led them to evacuate victims successfully from land.

Adaptive governance has emerged as a form of TEK in developing and developed nations. This approach to governance stemmed from issues pertaining to the management of common-pool resources, which are those resources in which an individual cannot be easily excluded from, i.e. fishing (Ostrom, 1990). The focus is on both the formal, and informal arrangements that are made among various stakeholders. These arrangements are made in order to manage resources and provide a different model for assessing what is a productive and equal institutional arrangement.

Though adaptive governance has been utilized mainly within the ecological resource management realm, others have adapted the concept to business and healthcare (Gulati & Gargiulo, 1999; Mitchell & Shortell, 1998; Provan & Milward, 1995). Adaptive governance, which is using local knowledge like TEK to solve governmental problems, can be utilized when planning and responding to disasters, just as it has with other operations in developed nations. The informal arrangements that were present during the waterborne evacuation are indicative of the arrangements used in adaptive governance.

As the TEK movement was furthered, it expanded from looking at indigenous people and the way they lived and started to focus on how it could be applied to all

ecosystems, regardless of whether or not indigenous people were present in the area. This new wave focused on using TEK as a new management practice that could be utilized by governments and organizations in many different areas. Growing and adapting can be seen as TEK, which is continually growing and changing to adapt to environmental changes. Utilizing TEK and other management principles can create co-management of issues, which seek to create the most sustainable solution to problems (Olsson et al., 2004).

Adaptive governance stands as the alternative to the command and control model that has been used in many government systems (Holling & Meffe, 1996). Government organizations must operate within an open system which combines many different organizations and is more complex than previous, simpler systems (Dietz et al., 2003). The maritime community was not involved in planning prior to 9/11. According to respondents, they were also not incorporated in planning in New York Harbor in the post-9/11 disaster planning. Though they proved their ability to use local knowledge during the successful evacuation, the merit of such knowledge was not deemed useful or did not coincide with the disaster planning process. The lack of the maritime community, much like other groups who are not traditionally involved in disaster services, can be incorporated by combining TEK and disaster management.

Conclusion

TEK is not just for indigenous societies in developing nations. Instead, aspects of the theory can be applied to non-traditional groups of people in developed nations. In fact, applying the theory to people not traditionally studied, as this dissertation does, a whole new TEK is emerges. No longer does the theory just explain resource

management practices. Instead, it can explain how groups and cultures make decisions, and those decisions can be helpful to communities as a whole, as was the case in New York.

The implications for this dissertation will be far reaching from public officials to the general public. When those in dangers of disaster, whether manmade or natural, better understand ways to protect themselves, loss of life and property can be lessened. Since technology cannot always be relied upon in times of disaster it is imperative that people be able to understand their environment and adapt them to it in order to survive.

CHAPTER 6

CONCLUSION

This dissertation has sought to further the study of TEK and provide a basis for other research into the topic in developed nations. In particular, the study has applied TEK to the 9/11 disaster. The waterborne evacuation in this event was a unique experience that was successful because of the traditional environmental knowledge of the maritime community in New York Harbor. By utilizing their history and experiences, both personal and passed down, they were able to successfully evacuate over 500,000 people. Those that rescued did so using their indigenous knowledge of the harbor to know the best locations to embark and disembark passengers. They also utilized rudimentary technology to send and receive information to other rescuers as well as those being rescued. This was one of the few shining successes that day, and they did so using their Traditional Environmental Knowledge (TEK) of the harbor and their mariner background to do so. Though the mariners alluded to a knowledge that they had acquired on the water, they did not specifically know that they were utilizing TEK in their evacuation experience.

People living in urban environments have traditional knowledge. This dissertation has sought to show what TEK looks like in an urban setting. TEK in a developed/urban environment can also be found in other settings. For instance, the use of the maritime community can also be studied in other water front communities (New Orleans, San Francisco). Also, the use of TEK in developed nations can be used in non-water societies in order to harness stories, local knowledge, etc., which can benefit planning and responding to disasters.

Review of Findings

The question of what constitutes “traditional” knowledge is what has stagnated TEK, not only within the anthropological field, but from branching into other fields. Traditional knowledge has focused on indigenous peoples and how they use their knowledge to navigate their environment. The environment in these areas is usually non-technological, and continually at odds with the elements. Meaning, there have not been technological advances which can control the environment in these areas, such as levees or advanced warning systems. Therefore those inhabitants of the areas must keep their traditional knowledge more closely linked with what was originally thought of as TEK. Specifically, stories and histories that are passed down in these societies are related to nature and its effect on the inhabitants of the land.

TEK was used during the evacuation of 9/11. The maritime community relied on their past experiences, maritime education, and knowledge of the harbor to evacuate victims. Their understanding of the harbor was directly related to the knowledge that they had previously had. Oftentimes, it was found that people are utilizing some form of TEK, from history or information passed down, but are unaware of its exact name. It is the hope that this dissertation will allow for a name to be put with general themes so that research can utilize TEK in more creative and expansive ways. By using local knowledge, people will be able to understand how and why doing things a certain way is necessary, i.e. how to evacuate from an area.

Limitations of the Study

Since this study was not meant to ask questions pertaining to TEK, there were limitations when combing through the data. This section will discuss the limitations of

the study, including sample limitations and data analysis problems. Many of these problems stemmed from the fact that the original study data did not set out to find aspects of TEK.

Limitations of Sampling

The original NSF study contained a sample of 100 study participants. All of these interviews were consulted when sampling. However, since the sampling was systematic (i.e., looking for elements of TEK discussed by participants), not all of the interviews were used. There were forty eight interviews that contained elements of TEK discussed by participants. When performing qualitative research reaching saturation is vital, and in this case was reached with the number of interview used. The same ideas of history, stories, education, etc. were discussed by multiple participants. This final sample size fits into Morse (1994) and Cresswel's (1998) prescription of having between 20-50 in-depth interviews in order to reach saturation of the topic.

Limitations of Data Analysis

The main limitation of the data analysis was that the original study did not seek to find TEK in the maritime community. Therefore, not all of the data from the original study was useful. Specifically, some of the questions that were asked were not always appropriate to the questions being asked in this dissertation. The questions over the sample size have been covered earlier in this section, so the limitations pertaining to responses and data will be discussed here.

First, the original study did not seek to find aspects of TEK in the maritime community. Therefore, the questions in did not specifically target TEK's tenants. Instead, they looked at aspects of improvisation. However, these questions did indirectly

allude to TEK, as did the responses from participants. The responses to the questions did provide rich data for analysis.

Second, the data was collected four to six years after the event. Then, for the purposes of this study, the data was analyzed five years after data collection was complete. This made interpreting what participants meant when they responded to questions, as well as them remembering small details about the day, somewhat difficult. However, the responses provided were adequate to paint a picture of their use of TEK in the evacuation, owing to the consistency of the mariners' recollections.

Third, when analyzing transcripts through Atlas.ti, single words or phrases were not always possible to search. This was because the questions did not ask about the participants' history or use of traditional knowledge. The only question that did ask about a tenet of TEK was pertaining to the participant's education. Though this question was very broad, and could have been taken as formal education (college) or traditional (on the water) education. For instance, one could not search for the term "history" or "story" and expect to find a match within an interview. Instead, intensive reading the transcripts for ideas pertaining to the different tenets of TEK was necessary. This was more time consuming, as well as caused myself, as a researcher, to think more expansively and creatively about how a respondent may describe their education on the water, how they couch their experiences in a historical context of the "water", and how they go about quantifying their relationship to the maritime community.

Though there were limitations when analyzing the data, they were overcome through rigorous analysis. Specifically, utilizing grounded theory methods to ensure data was analyzed correctly.

Implications for Emergency Managers

Local emergency managers can utilize local knowledge in order to successfully deal with disasters. By utilizing this knowledge in training and practice, those who are tasked with responding to disasters can be best prepared for them. Emergency managers can use knowledge in many different ways, from historical knowledge passed down through generations in one area, to “new” knowledge acquired from living in a built environment for a period of time and technological advances. TEK within the context of a developed nation may look different from what TEK has generally been associated with (traditional farming practices). Emergency managers must not just focus on how the environment can affect people but also how technological advancements (nuclear power plants, dams), war (refugee camps) or terrorism (attacks such as 9/11) can create a new environment that must be navigated.

Using the theory of TEK, usually reserved for understanding how indigenous societies function successfully, and applying this to developed countries’ ideas of disaster planning and response, emergency planners, public officials, and lay-persons will be able to acquire a better understanding of their environment and how to work with it, not against it. This, in turn will allow for a more regionally tailored response when dealing with disasters and, hopefully, a reduction in the loss of life and property.

It is imperative for those involved in planning for evacuations to think outside the box with the traditional modes of transportation that have dominated the latter half of the twentieth century and into the twenty first. Using what has worked in the past, such as boats, is one way to evacuate many people at once. Emergency planning must incorporate more effective modes of transportation when evacuating people, but this

also requires preparation before a disaster. In order for this to happen, the entire community needs to see the value of a working waterfront prior to a disaster. The current movement of waterfront redevelopment does not allow for this, but it is vital that some aspects of the movement incorporate the previous use of the area into their design.

TEK can be applied to all four phases of emergency management. In the instance of this study, it has been applied to the response phase. However, it can also be applied to the mitigation, preparedness, and recovery phases. The mitigation phase can incorporate aspects of TEK when choosing where to build settlements (i.e. out of traditionally known flood plains, using native building materials to construct homes, understanding local weather patterns). The preparedness phase of emergency management can utilize TEK by incorporating those with local knowledge into the planning process. By understating the stories, histories, and local knowledge and using them while planning, the helpful aspects of TEK will be incorporated in disaster planning. During the recovery phase of a disaster, TEK can be used to plan for the next disaster and lessen the impact of future disasters.

Recent disasters, such as Hurricane Katrina, and the Tohoku tsunami, have shown the weaknesses that populations have in mitigating, preparing for, responding to, and recovering from all types of hazards that are encountered in certain geographic areas. All too often traditional ways of using land and understanding disasters are abandoned to make way for new technologies which are supposed to improve disaster understanding and response. Traditional knowledge has been abandoned or ignored by new generations, or, with the mobility of the population, some individuals are not

originally from an area and are unaware of the land, and hazards around them, including technological or man-made hazards. It is only apparent after a disaster that the new technologies and land use is not always the best, i.e. communications (telephones, internet) nearly always go out during a disaster, leaving organizations unable to correspond.

TEK can be harnessed in many different situations within developed nations. Emergency managers and planning officials need to take into account the way people live, and their environments, in order to successfully plan for and respond to disasters. This includes understanding the knowledge that has been developed in an area, even in recent decades or years. By doing so, emergency managers are arming themselves with the most comprehensive planning and responding mechanisms to disasters.

Future Directions

This study is by no means an exhaustive effort of the role that TEK plays in developed nations, especially during times of disasters. Instead, this study offers a starting point for researchers and practitioners to expand upon where themes of TEK will fit into their research and workplace. The boat operators of New York harbor are a small subset of the population, yet offered valuable insight into how people think and act and why. They also showed that not just developing nations with indigenous people can have indigenous knowledge that can help during a disaster.

TEK must become more developed in order to survive in the current academic and professional environment. Oftentimes, TEK is alluded to by scholars in the form of historical knowledge that is acquired by people. Also, professionals, specifically emergency managers, use lessons learned from prior disaster experience to further

their knowledge and affect change when they are preparing for and responding to disasters. Therefore, using TEK is not out of the ordinary for many, instead, the theory needs to become wider known and utilized by more people for it to become stronger. This can be done by researching more instances of TEK in developed nations. Then, taking those findings and applying them to disaster situations where local knowledge is vital to preparing for or responding to disasters.

The information gathered from this dissertation calls for a new definition of what “traditional” means and who “indigenous” people are. From the information that has been gathered through the study, it is apparent that tradition can be carried on by many different people, not just those living in small mountain alcoves in remote locations. Redefining indigenous and traditional ideas may seem counterintuitive because TEK has been so often used to describe indigenous people.

Future Research on TEK

Researchers need to apply the principles of TEK to all aspects of emergency management, specifically in developed nations. In order to do this, more interdisciplinary studies need to be undertaken. Broad questions might include: “What is the current state of TEK from a developed nation perspective?”; “What are the differences between TEK in developing and developed nations?”; and “Can TEK be utilized in all phases of emergency management?” These questions are integral to propel TEK into more disaster studies.

These research questions can be studied by looking at events that have happened in the US and other developed nations. For instance, the use, or lack thereof, of the maritime community in the evacuation of New Orleans during Hurricane Katrina

can be an example of TEK in another developed nation. This specific study would also give insight into less successful uses of TEK.

In order to answer these questions, many different disciplines need to work together. Public administration, disaster scholars, and research not associated with anthropological disciplines need to educate themselves about TEK. They need to do this to gain a better understanding of how they can study and utilize TEK in their respective disciplines. Also, by studying how TEK is beneficial to other disciplines, in developed nations, the merits of TEK can be expanded upon.

TEK for Future Education

Aspects of TEK and the effect on emergency management also need to be discussed with the classroom and other educational settings. In order for those tasked with conducting the four phases of emergency management to know how TEK can be useful, teaching TEK must start early. This can take place in multiple forms, such as in emergency management classes at the university level, or incorporated into courses offered by FEMA or during professional conferences.

Educators should provide a solid background of what TEK means, what its history is, and how it has been used in the past. Then, the benefits of using TEK in a developed nations and disaster setting should be discussed. Examples of how TEK is useful, such as this dissertation, can be provided to show students how to utilize the method in “real” life. Also, discussing how TEK can be useful in all emergency management situations can be helpful when encouraging future/current emergency managers to utilize TEK.

Conclusion

Previous studies about TEK have underscored the themes of history, stories, education, and experience in developing nations. This dissertation has found that TEK was effective when used by a developed nation and should be integrated into the current disaster system in the US. The study has also provided examples as to how researchers and emergency managers can take the new information and use it in all phases of emergency management in order to create a cohesive approach to disasters. TEK has not been utilized to the extent it can be in developed nations. This, in turn, has caused missed opportunities for research, education, and its application. It is imperative for researchers and practitioners to utilize TEK in order to harness its benefits and emergency management.

APPENDIX A
INTERVIEW GUIDE

Interview Guide
Collaborative Research Proposal on Improvisation and Sensemaking in Sudden Crisis
University of Delaware and University of North Texas

As you know, we are carrying out a study that focuses on how organizations and vessel operators responded following the attacks on the World Trade Center, particularly their involvement in the waterborne evacuation of Lower Manhattan and boat lift operation of emergency supplies and personnel. We are also interested in the extent to which they were involved in pre-planning efforts, and planning efforts in the harbor since 9/11.

I want to start with a few questions about your vessel or the facility you worked from at the time.

1. Please explain your job at the time of the attacks.

(Probe: Is the interviewee a vessel operator; If so, what position on vessel; If not, what do they do and what was their role in the harbor at the time; How long had they worked in the harbor prior to 9/11 and in what capacity)

2. What type of vessel did you work on at the time?

(Probe: size, passenger capacity, general functions? OR What type of facility did you work from and where was it located? Probe: who else was there?)

Thank you. I want ask a few questions about you and your involvement in the emergency response following the World Trade Center attack.

3. When the first plane struck on September 11, where were you and what were you doing? Please walk me through that morning?

(Probe: At work, on the way to work, off duty? Doing what he/she would normally do? Doing something different that day? What was going on around you? Who were you communicating with and about what? How were specific decisions made?)

Please show me on the chart where you would have been.

Were there any other vessels in the area?

Where were you headed?

What did you do next?

4. Where were you and what were you doing when the second plane hit?
(Probe: What was going on around you? Who were you communicating with and about what? How were specific decisions made?)

Please show me on the chart where you would have been?
Were there any other vessels in the area?
Where were you headed?
What did you do next?

5. Where were you and what were you doing when the first tower collapsed?

(Probe: What was going on around you? Who were you communicating with and about what? How were specific decisions made?)

Please show me on the chart where you would have been?
Were there any other vessels in the area?
Where were you headed?
What did you do next?

6. Where were you and what were you doing when the second tower collapsed?

(Probe: What was going on around you? Who were you communicating with and about what? How were specific decisions made?)

Please show me on the chart where you would have been?
Were there any other vessels in the area?
Where were you headed?
What did you do next?

I would like to take a step back and ask a few more detailed questions about what happened in those initial hours.

1. When did you become involved in responding to the attacks? How did you decide to become involved?

(Probe: Did the interviewee become involved spontaneously, by plan, ordered by the Coast Guard, or by a directive given by a superior?)

2. What kind of contact, if any, did you have with government agencies such as police, fire, or the Coast Guard?

(Probe: To what extent, if any, were you directed in your efforts by some authority, such as the Coast Guard?)

3. Did this contact differ from kinds of contact you had had with them in your regular work? If so, how?

4. What kinds of information were you receiving initially, and from what sources? (Radio, television, VHF radio, visual?) Did this change over the course of the morning? If so, how and when?

Thank you. I would now like you to walk me through the rest of that day, September 11th.

5. After the second tower collapse, what did you do next?
6. Were you involved in the evacuation?

(Probe: Who were the passengers you were carrying (emergency responders, residents from Manhattan, commuters, could not tell). About how many passengers did you carry? How many trips did you make? If your vessel doesn't normally carry passengers, how did you accommodate them?)

7. Were you involved in the boat-lift of supplies and equipment? Please talk about how that came about? (e.g., take passenger one direction, emergency personnel and supplies in the other direction)
8. Which organizations did you come in contact with at this time? Which vessels did you come in contact with? Where and when?
9. Were you involved in any other aspects of the response at this time? If so, what?
10. Please show us on this chart the places where you picked up passengers, where you disembarked them, and the route you followed?
11. What organizations and vessels were at these points? Please make reference to the chart.
12. Please show us on this chart your usual operational area and the routes you normally followed in the harbor (prior to September 11)?
13. What organizations and vessels were typically at these points, on the days before the disaster? Please make reference to the chart.

We are very interested in the network that was in place prior to 9/11, the network that emerged on 9/11, and the extent to which that network drew upon existing networks or was quite new.

14. Who were you in contact with, how, and what kinds of information were you exchanging? Or what types of activities were you engaging with them in?

15. To what extent were you familiar with the other people, or boats, or companies that you interacted with?

I want to specifically ask you about some of the people, vessels, or organizations that you mentioned earlier

(Probe: Ask if they knew them before and what kind of information they exchanging or what kinds of activities they were engaging in?
Specifically, how long have you known these people? How closely do you work with them (contact more than once a week, once a month?)

Thank you. The next set of questions concerns the use of plans and planned for action during the waterborne evacuation and boat-lift of supplies and personnel. It also includes questions on the extent to which activities were improvised or unplanned for.

1. Were you aware of any planning that had been done prior to September 11 for evacuating Manhattan? If so, what did that planning involve?
2. What are examples of contingency plans, or a Plan B, being used during this event?
3. Were there any examples of rules or procedures that were appropriate in normal times but that could not be applied in this event? Please give me some examples.

(Probe: What happened in this circumstance? What was the outcome and how was it achieved?)

4. Were there any plans or procedures that were appropriate given the circumstances of the disaster, but for which you needed to find a substitution to make do or improvise in this specific way? Please give me some examples.

(Probe: What happened in this circumstance? What was the outcome and how was it achieved?)

5. Were there any entirely new procedures – even temporary ones – that were established? Please give me some examples.

(Probe: What happened in this circumstance? What was the outcome and how was it achieved?)

6. Did any of these new or temporary procedures become permanent and if so, how?

7. What elements of your education and experience were important in your response to this event?
8. What equipment or procedures would have facilitated the evacuation had they been available?
9. What information would have helped you during this event that you didn't have? What kinds of information were helpful?
10. What were some of the other factors—equipment, layout of the harbor, construction of the boat—that may have hindered your work in this event?
11. What types of tools or equipment needed to be improvised? How?
12. What are other examples of ways that you or others improvised that day?

The last set of questions focus harbor planning and recent activities.

13. Are you aware of any planning that has been done since 9/11? If so, what planning? Have you been involved and how?
14. Have you been involved in any harbor disaster drills or exercises? Were you involved in any before the attacks?
15. Were you involved in the evacuation after the August 2003 power failure? To what extent did lessons learned from the September 11 effort come into play in August, 2003?
16. Is there anyone that you recommend that we talk with to learn more about this response? How would we best find out how to contact them? (Get names and contact information)
17. Do you have any documents that we would be able to look at (logbooks, charts, etc.)?
18. Before we end, is there anything more that you would like to add to anything that has been said – Anything more we need to know about how the harbor response to 9/11 was carried out and managed?

APPENDIX B
CODE BOOK

CODE	Participant ID	Quote	Pg #
History-personal	39	And then I would preceded giving them a safety briefing like you would if you went on a passenger vessel. I've done enough as a marine inspector.	12
	42	And because I did a lot of work around the harbor in different locations on a regular basis, I'd bump into a lot of different people.	3
	42	And I knew all those guys because I used to run the Harvey for them.	6
	27	I guess a professional time on the water. More of the instinctive stuff, just going to the boat, knowing this is down here, get the boat out of here. Help anybody who needs some help nearby, aid to those in peril.	12
	27	I've been working in New York Harbor since 1987.	1
	61	I just know how to run a boat. We've been on boats since were kids. We were on fishing boats.	27
	53	Well, they may have had different perspectives, everybody respected where everyone else was coming from and generally I think they knew each other.	
	8	I've been doing this business for over 30 years now, when a disaster occurs, it's all hand on deck.	7
	8	I've been doing this for 30 years, but I've worked in various companies, I'm on a first-name basis with oodles and oodles of people in different companies	14
	2	We all know each other and we trust each other.	2
	6	I said "look I know people in Bayonne, I grew up in Bayonne. I know everyone there. I have a cell phone. I'll call the people. We'll drop them off there."	10
	17	I used to work at Cirlce Line as a captain and as an engineer, so all of the captains that work at Circle Line I know.	12

	6	I've been working in New York Harbor since I've been 17 and I scoured the waterfront. I studied the charts. What can you do, what they do here, what they don't do here. What kind of boat can go in here, what kind of boat can't go in here?	20
	6	Being that I worked on a tugboat, we went to every pier there was	20
		I started out as a dishwasher and worked my way up. A lot of times on the boat, the company would say somebody can't make it for a few days on one boat, you want to go over there and fill in?	21
	17	A lot of it was based on my prior experience in '93	8
	49	I believe my great-grandfather used these boats to help supply fuel (during WW I).	14
	25	There was prior experience form 8 years ago. But it was pretty much the same kind of response. If there're distressed people on the seawall, the ferry boat people go and pick them up.	
	23	We know everybody, See over here is a pretty close-knit things	
	33	So I'm fourth generation. We originally started as a litharge company. Sailboats moving cargo around the harbor of New York	1
	35	So I knew, if there's a fire there, the only evacuation from lower Manhattan would be by water.	1
	40	I was involved in another mass rescue. When all the Cubans and Haitians were leaving from Haiti and Cuba.	10
	43	I've done a lot of genealogy of my family for 350 years and how they all lived on the water.	12
History-maritime	39	So, Ken Peterson, being port captain was going to head up the little flotilla, they would get underway, the armada.	5
	47	In our industry I's not, you know, it's just, you do what you have to do. You do what needs to be done.	17
	47	It's a part of what you do. I mean, if somebody's out in the water is in need, that's you you do, you know? You help.	12

	47	If something breaks on a ship in the middle of the ocean, somebody's got to fix it.	
	34	And I'm thinking to myself, I had two incidents where I was reminded that at Pearl Harbor we ammo dumped the sergeants that wer ein charge of the ammo dumps.	16
	27	I think it all happened because the instinctive needs of those in peril and professional operators on the water.	17
	6	9/11 was like, it was like Dunkirk	30
	24	I believer it was almost high tide when we started out, so everything was you know, everything was pretty even as far as in the boats, the people on the boats and the dock. Course, we did it in a course of like 6 1/2 hours so, you know, at that time the tide had changed and everything so we had to make some changes in getting people on and off the docks.	6
	55	Went out of their way to get to a point where they could help and find a way. To get in contact with people and say, "Okay, I'm here, what can I do?" You know, these guys had resources, the boats.	11
	39	To my knowledge it was unprecedented. Other than maybe Dunkirk, were the tugs came over and got the British army off before the veer mock came and destroyed them and got them back to England.	34
	8	It's a tradition of being on the water. Something happens, you respond. If we were here talking about a collision between two tankers right now, it'd be the same answer	8
	8	Boating tradition, it was more or less doing what we had to do.	9
	8	In the maritime industry, if there's a collision, keep in mind, that there is no fire department, you're it. Man overboard, you're it. Whatever the disaster, you're it until somebody can come to your rescue.	7

	2	You did what you had to do and that was it. You didn't ask permission, you didn't ask questions, you just did it.	18
	2	You go along the Thames and there are simple things like there's a life preserver and a station every hundred meters or so.	29
	6	You've got to physically sink this boat from under, I'm going and like a volunteer fireman showing up to a house on fire. This is my job, I'm going in.	8
	6	It looked like one of those Haitian ferries, overcrowded with people.	11
		Here's the other ferry evacuation route. This is called the shipyard. This used to be the Hoboken Shipyard. There used to be all kinds of piers back here where they used to rebuild ships. The ferry slip is right back here.	32
	6	You know, it's gotten to the point now in New York Harbor where if you need a place to hang on, to just tie-up for a couple of hours, you can't do that anymore.	22
	6	I can draw it up, every buoy on the chart. I said, we can go in here, and they said, no we can't go in there, and I said oh yes we can.	21
	7	Tugboats used to tie up all through where the sea port is and all to the Battery. The tugs would tie up there and the captain would stand on the deck. They'd yell out the window in a megaphone to send the deckhand up and they'd write the guys order on it, hand it to him, and he'd go to do his job, that was, it was kind of ironic, that, you know, they were retouring to that place.	11
	7	If something breaks on a ship in the middle of the ocean, somebody's got to fix it.	12
	9	It was just nautical stuff, just passengers, get them off.	13
		I guess second nature would probably be the right word for it. It was just what we did.	14
	17		6

	17	It was all shipping piers, all up and down the west side.	6
	51	But tugboat crews, they know each other, they all talk and they all are part of the same group.	14
	49	All companies responded regardless. I don't believe there was any call for help. At least here there wasn't a call cuz we were all just like "we should go, we should go."	16
	48	I think the maritime community has a long history of doing that. There's something about being at sea and always being there to aid somebody else. And I think there's just a history when we're always there to aid somebody who's in distress.	17
	48	When guys go out to sea, it's them and sea and there's basically nobody else. And when you're in distress there's an obligation then to aid your fellow seamen. There's just a history of that in the maritime community that extends into the community, even within the harbor.	18
	58	You learn that operating if there's an emergency, a man overboard or a fire on a vessel, you use your knowledge.	17
	58	Today in New York, they're putting in a lot of green space without the docks, which is kind of sad because I seen the funding going more towards public access to walk to the edge but not get over the edge onto a boat or a dock.	29
	60	It's sort of like you do what you can and as long as you're not injured and you can stand up, you stand up and help out anybody else that needs help. And that's sort of a belief; it's like an old SOS or rendering care to someone else who needs it. And it's more than just a belief, it's a code of ethics and behavior and it was very prevalent because they were mariners.	8

	60	Now the reason there was such a sense of camaraderie is because there's people had worked together for years for months. But again, that overriding principle of you do what you can, you stand up and you try to help out. And that is a principle of the maritime industry and it permeated every decision.	19
	57	We've learned from our experience in the past, we were involved in the 93 evacuation previously.	2
	33	They just called for help and the natural reaction of almost all mariners is to go to the aid.	11
	33b	I think the average mariner was ten times more prepared to any kind of emergency than the average office employee.	33
	33b	They have an obligation to come to the aid of people in distress, if it doesn't harm. And they're written from Roman Code, from Roman Law. Over two thousand years old.	33
	33	You know, years ago there used to be all these wooden piers all around Manhattan so fires broke out constantly. And they had a tremendous fleet of fireboats.	34
	44	I think it's the thing of trying to help every man out there. They're in boating distress, you don't go by, you stop and help them out and I think that was the tradition from the old days, and I think that's how people have been doing it for years.	11
	44	It's a rule, you have to help a vessel in distress. You can't just go by and just let the boat burn down or go on fire. OR it's a man overboard in the water, you can't, no matter what you have six hundred or seven hundred people you have to go help him	17
	44	They're always going to help you. Somebody is going to help you. That's how it is, how they got it, I don't know. But it's the rule and that's how I was brought up in the industry. If somebody needs your help, we have to help.	17

	30	I think it's just human nature, you see this going on and I truly believe that maritime people, because the business is so high risk even in normal day-to-day operations on a perfect weather day, that there's always been this law of the sea that if there's someone in distress, you respond.	15
	40	I think our culture is one of you can be 200 miles off shore and you really can't ask how to go about. So, it's do the mission.	9
		One interesting aspect of all of this is that we, in the changing waterfront here in the Hudson River park which were in technically. There is a culture of people of a certain age who were really opposed to vessels and piers.	15
Education-on the water	39	Well probably based on my Coast Guard experience working on certain search and rescue cases at sea. Which are, the Coast Guard trains to render aid or assistance at the sea.	5
	26B	I had a lot of ship-ward experience, a lot of operational experience, search and rescue, enforcement, command and control, those types of things	6
	23	The 4 years in the Coast Guard, definitely and then the education I got from being a fisherman on the boats.	17
	39	It was simply ok these fire boats do that. Some of it was based on the size and capacity of the vessel	8
	39	I guess what happened was we arrived and moored up against the bunk head here, I call it, you know the little sea wall. At Battery Park, right by Battery Park.	7
	24	"They have a max, every boat took a max from the State of New Jersey one of the boats can only hold 400 people. SO that's how many people, but when we first started out, they were putting as many people as possible.	8

	39	Knowing the vessels in them, only the crews or capabilities, knowing that we could carry passenger or knowing that we could accommodate logistics support and put stuff on deck, I think that it helped a lot, and just years of experience in the water and working and knowing the geographical familiarity of the port of New York.	27
	15	There was no education, it was just something that any person that had the resources would do.	14
	15	You know, the tug boats, you don't know who it is, the actual people working on them, but you do know the name of the tugboats, you know what business they are in.	11
	7	These guys and the people who are trained to go around the clock. There was nobody that had to go home at 5 o'clock from the boat, they were living on the boat.	19
	7	We did what we normally do.	20
	9	I was a dock master...that's what I did from 1979-94	18
	29	I worked for Reinauer for 22 years. I started working on the tugs in 1979.	2
	58	We're required to do drills, on the vessels and crew training.	16
	33	I went commercially, deep sea for a short period of time, and then ran on tugboats. I graduated as an engineer. Rose up through the ranks and became a master and pilot of unlimited tonnage.	2
	44	I went to a maritime school; it was like a high school that was a technical school. I worked on medina boats since 1979.	12
	37	Well, we were, everybody is on channel 13, which is ship to ship.	5
	40	And the reason I opted for the pilot base, the reason I opted for the New York was recognizing that Sandy Hook pilots bring a lot of knowledge. A Sandy Hooker does have knowledge for these guys. They do a 14 year apprenticeship before they are a pilot.	5

	16	Yeah, I grew up on sailboats. We had a 1931 164 foot heavy motor yacht, that's how we found out about the pier.	20
Education-"another life"	39	I came as safety director and also in face that at the time I was a certified EMT. I brought first aid kits and oxygen and some other things that might be useful to any kind of injured and traumatized people...	5
Stories	39	And also the, start to, you know, do a actually a walk of the site to determine what the scope of the damage was. I mean, you know, look at it, it looks like, to put it into perspective, you've seen movies where a bomb goes off in a city or you know, some of those World War II films. It, it looked like that.	14
	9	They were orderly and they were shell-shocked. It looked like, you know, the retreat from Stalingrad.	10
Improvisation	39	And we, we started making up makeshift signs and plackets of cardboard telling us. It said, you go here, you go here. And we hung up, hang up these signs by the vessels so it seems like you're on a dock.	11
	37	Here was the dock that you had to fence and it had like the different rails on it. So, we actually had to take an axe and cut these out.	14
	50	There were very few fittings for us to tie to and later on we figured out a mooring scheme, we were able to kind of lash the boats together.	6
	24	So we made sure that we put makeshift steps up that we would sit and make sure that we could board people.	12
	24	So we were, nobody was prepared to carry a gangway at this time so e basically had to grab some people and, you know, throw them over, it was dramatic but everyone helped out	6

	2	It's not built to standards for marine use, we had tugboats alongside here, we had our Pilot boat alongside here, but we were tying up to trees and things.	30
	6	I would give hand signals'. I used to give hand signals of how many ambulances we need and how many people need to be treated	4
	29	A couple of milk crates that we had from down in the engine room we got to make a step.	12
	38	They could all communicate amongst themselves using VHF radio.	2
	25	A tugboat comes in and they have a bed sheet hanging out of the front window that says "Staten Island" written across it in crude letters and at about that time the boat captains had discovered that they would have a simple way of advertising their destinations. Some boats would say Jersey City, some would say Staten Island, some would say Brooklyn	15
	16	I mean, our bollards were trees.	9
Boat knowledge	8	Communication is generally Channel 13, bridge-to-bridge communication. Now it's VHF, but it really wasn't affected by any of the stuff that was going on and that if you had to talk to somebody else, you could switch to a working channel and talk to the other boats at that point.	5
	47	We used our judgment, how many people to put on the boats that day.	18

	27	We do it by the numbers same way we always get off the dock, forward on the string line.	3
	61	But all the guys who ran the boats all knew, you know, how to handle them.	10
	61	You see over there you're in a lot of tide. The tide's either coming out or it's coming in along the. You're trying to dock on the wall, there's here and the tide is either running this way or this way, but you got to keep your bow into the tide.	10
	61	It only took us like ten or fifteen min to get everybody on, we had like 340, 350 people. We lost count of them.	8
	61	He'd say 200, all right, keep up, keep going. You saw so many people waiting to get on. He didn't want to say ok, only put 220. So we put on 250, we put on 300 and said, okay, that's enough. You didn't want to put like 600 on it or you'll have people turning the boat over.	20
	37	I mean, we were supposed to put 80 passengers; we were putting about 90-95. You know, we were going 10-15 maybe 20 people over the limit, but I kept basically everybody on the lower deck for the stability and I knew it, everybody, I know what I was doing.	13
	37	After the initial hit, about the first 3 hours, we were overloading by 20 passengers easy.	4
	8	The tugboat guys had what you call local knowledge. I mean, you're not going to be the captain on a tug in New York unless you know where you're going or where the boat can go or where it can't go to and you basically are communicating with these people on a daily basis, you know who the players are.	6

	6	We got on the radio, and we just made blanket calls on Channel 16 and 13.	12
	2	I mean, a tugboat is only certified for probably a dozen people? I mean, you got 200 of em on there.	33
	29	I definitely overloaded the people (on boats)	10
	17	Horse power of the vessel, capacity of the vessel, gangway coordination, that's second nature, that's like an electrician having inherent knowledge or a computer technician.	8
	6	We had an advantage, we knew, as local mariners; we knew what boats like the Miriam Moran. We pretty much knew how big it was, where it could go, where it couldn't go.	14
	51	The captain and the mate, you know, pretty much figured out to get the boat nosed up and how to get people aboard as safely as possible.	16
	57	We docked anywhere we could. I mean, we were bow loading off the Battery; the tide was right so people could just jump off and on.	6
	28	Safety, you're trying to protect the vessel and trying to protect the people. Your crew and any passengers, so you want to be aware of the safety of the boat and personnel	10
	30	Bow in and then if there was enough run then basically put out a line and go side to the dock. So, if based on the level of the tide of the harbor, their bow would be even with the seawall.	10
	40	He knew the people on small boats and what their capabilities were.	22

	50	The tug would back out, and there were several tugs offshore that would take its spot. So, during that thing there was no true mooring, the boats were just using their own propulsion to hold em against the wall.	13
	16	Normally, we try to keep it down to 60. WE took about 150 people and went up to the south side of Pier 40 where we dropped them off. (overloaded boats)	7
Harbor Knowledge	8	Local knowledge, knowing the fact that they can get out of there from 34th street.	8
	35	I know where the currents are swifter and if you have a heavy parallel current you want to be able to nose your boat into the current, things like that.	13
	35	I knew we had deep water there. I had keys to the facility so I told the police. I said , this is where I want everyone moved to.	6
	27	Because I knew the channels to go to, 17 for harbor trailers, cops 15 ship to ship 16.	11
	8	One of the keys of what took place there is the knowledge of what we call in the marine field "local knowledge", of where to go. You just can't drop them off at a certain pier that you know has barbed wire gates with dogs on the other side of it.	12
	8	Local knowledge of where people can get on and get off was prevalent in the decision making process of where we're going to disembark. You know, you couldn't just got to something on a pier in Brooklyn or Manhattan, you couldn't get off there	17
	8	There's many occasions that boats know you can pull up there, depending on where the water is, how deep your vessel. There's enough water here that you could pull up and along.	17

	8		19
		There were all drawn out, any chart you got here, from memory	
	2		19
		It was a condemned pier right across the way and we would just take it all.	
	6		13
		If I couldn't get in there I went into East 34th St. and there was another loading place. There's a commuter barge there.	
	15		9
		We were draw a little but more in that , so we couldn't get into that, and also we had to look for areas where we were able to fit in.	
	9		7
		They nose up to the dock, don't put lines out. They keep the engines running and people walk on and off.	
	9		19
		As the tied changed, we had to sometimes we were using gangways as the tide changed and it was getting more and more difficult.	
	29		6
		Everybody just kind of nosed in and it just seemed to work.	
	29		10
		I heave out and I was sitting out right around here, you know, right out in the middle of the harbor just were, there's no better place to go.	
	17		8
		New this is where any mariner that's a captain or above responsibility mode, in New York, should have inherent knowledge of the fact that tidal range is gonna greatly affect your decision of where to embark and disembark passengers.	
	48		7
		Unfortunately see in Hoboken they built a brand new park on a pier on the water. But they don't have any facilities for a boat to pull up/	
	58		18
		I mean, the riskiest thing we did was boarding people in a seawall that wasn't equipped for it. The railings you had to go over. You didn't have time, but you try to be selective as to where you would go. That's why we were at North Cove. It had a lower dock.	

	57	We try to cordon off the access point to the barge, we've learned over the years that we can't let the landing itself be overrun.	3
	57	You know at any given time you maybe got 30 ferry captains on the water, 40, you know, they know each other. They communicate.	14
	23	I think by choice we went to piers that we knew would take our boats.	20
	50	The captains were every professional, they were respecting Channel 16, which is the emergency channel, and Channel 13, there working channel.	6
	40	He's been stations in New York harbor in that small boat station prior to coming up to work for me. He knew the harbor too because he'd been there on those small boats.	22
	25	When the harbor's shut down you don't have the monstrous waves to deal with, so the boats can come up, push their bows up against the bulkhead and find a spot	26
Allusions to the water	25	We either were going out into the sea of people that was streaming south and I don't think you could even get out of either door before you'd be swept by them.	8
	33	It looked like a tidal wave coming at you.	6
martime community	44	First of all the community is very small. We think it's a lot of us, but it's not. So we know each other and when somebody needs help we can talk to each other.	17
	30	And we spoke to our friends at the other towing companies around the harbor.	6

	30	This harbor is made up of all these family owned companies and there's so many old time maritime people here that work for the Port Authority, work for the steam ship agents, the Pilots.	8
	40	Well there's only like one degree of separation in the maritime industry and by that I mean if I didn't know someone personally the pilots knew them.	18
	28	It's a small community. You know pretty much everybody, and if you don't know them directly, you know them through somebody else.	8
	61	So I knew all the captains that were on them boats.	13
	27	I interacted with many times, so all these guys. Mostly on channel 13, rarely face to face.	11
	35	The tugboat captains all know each other. It's a very courteous community.	4
	35	Everyone knows everyone.	8
	35	You did what you needed to do and no one, no one questioned it.	9
	35	No, it's not for a lands-person.	14
	47	They've been in the industry for many years. When you've been in different companies, you know, you get to know each other after a while.	10
	42	And again that's, that comes down to all of us knowing each other.	15

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