Comparing stakeholders' objectives for oil spill response: A Q study of Buzzards Bay and San Francisco Bay

A technical report submitted to the Coastal Response Research Center by

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1. Introduction

This paper reports the results of a study about the relative importance of objectives to stakeholders in two regions for which marine oil spill response is a critical issue. This study has been performed as part of a larger research project whose goal was to better understand the role of performance metrics in oil spill response planning and to propose a process by which oil spill response planning can integrate views about response objectives and performance metrics from multiple stakeholders.

As part of the empirical component of our research project we addressed a series of questions:

1) what do people think ought to be the objectives that guide marine oil spill response?
2) what are the relative priorities given to those objectives by different people?
3) what performance metrics do people think should be used to evaluate oil spill response?

A report describing our findings about the first and third questions has been prepared and is available (Tuler et al. 2006a, 2006b). Our findings regarding the second question are presented in this paper. We studied the diversity of views about objectives for marine oil spill response and their relative priority in two regions: Buzzards Bay, Massachusetts and San Francisco Bay, California. We begin this paper with a discussion of the research method used in the study, Q method. Then, the results from the two regions are discussed separately. We conclude with a brief comparison of the findings from both regions.

2. Research Methods

The purpose of this study was to identify perspectives about the objectives that should drive oil spill response among diverse stakeholders (including federal officials). Toward this end we used Q methodology (Brown 1986, 1996; McKeown and Thomas 1988; Kalof 1998; Niemeyer et al. 2005; Tuler et al. 2005, Tuler and Webler 2006). This is a type of discourse analysis that integrates quantitative and qualitative analyses to understand, in depth, the points of view on a subject. By inquiring of people with unique points of view, Q researchers can reveal patterns in how elements of perspectives are related. In this section we describe our choice of the two cases and our application of Q method.

2.1 Selection of case studies

In an earlier phase of our project, we conducted two case studies of oil spill response on the Atlantic coast. We conducted interviews with people concerned about oil spill responses associated with two recent spills: Chalk Point, MD and Bouchard-120, Buzzards Bay, Massachusetts. Findings from these case studies are documented in an interim report (Tuler et al. 2006a, 2006b).

For this Q study we wanted to return to one of the initial case studies, as well as gather data related to a new case. Thus, we first returned to conduct a Q study in Buzzards Bay and we met with many of the same people that were interviewed initially. We chose this case because the Bouchard-120 spill was relatively recent, there was quite a bit of diversity among research subjects about the quality of the spill response, and the research subjects were willing to give us more of their time to participate in our Q study. In addition, we were able to identify and include additional research subjects in large part because of the work of Rebecca Kay, our graduate student, on her master's thesis. Data for this case were gathered during July – Sept. 2006.

For our second case we wanted to gather information from people in a new region. This would allow us to test the robustness of the protocol that we developed for the Q study, including the applicability of the set of Q statements (see below, Table 3). We approached selection of a new case in two ways. First, we identified those regions for which ecological risk assessments had

been recently completed (i.e., within the last several years). Second, we asked CRRC staff for assistance to identify a point of contact that could help us identify research participants efficiently. Ultimately, this led us to San Francisco Bay. An ERA was completed for this region in 2000. Data for this case were gathered during November 2006.

2.2 Selection of research subjects

We selected individuals to participate in our research who:

- have been actively involved in spill response planning and implementation;
- represented different institutional affiliations; and
- were likely to have different views about spill response objectives.

In the Buzzards Bay case we were familiar with government officials and regional and local stakeholders from our earlier work and the masters thesis work of our graduate student research assistant. 16 people completed Q sorts; twelve we had interviewed earlier as part of our initial case study effort (Table 1).

In the case of San Francisco Bay we discussed our needs with Jordan Stout, NOAA Scientific Support Coordinator (SSC) for the region. He helped us by providing background information about the region and spill response planning and by identifying a diverse group of people to include in our Q study. Thirteen people completed Q sorts, as shown in Table 2.

Then, the identified individuals were approached via telephone and introduced to the project and told how they were selected. We described our data collection procedures and what we wanted them to do. We told people we would visit them at a time and place convenient to them and that the entire process would take about one and one-half hours.

Table 1. Affiliations of participants in the Buzzards Bay Q study

- Environmental educator/advocate
- Harbor master
- Local environmental planner
- Local fire chiefs (2)
- Local residents (3)
- Marine Spill Response Corporation
- NOAA
- Regional environmental planning organization (2)
- State agency staff / first responder
- USCG
- USFWS (2)

Table 2. Affiliations of participants in the San Francisco Bay Q study

- BLM's California Coastal National Monument
- CA Coastal Commission
- CA Office of Spill Prevention & Response
- Chevron Energy Technology Company
- Fish & Game NRDA Specialist, OSPR
- Fish & Game NRDA Specialist, OSPR
- Gulf of the Farrallones, National Marine Sanctuaries
- Marine Spill Response Corporation
- NMFS, NOAA Damage Assessment Center
- NOAA
- NOAA's National Marine Fisheries Service
- Salmon & Crab Fisherman
- USCG, District 11 - Response

2.3 Q Method

In Q methodology, the researchers gain access to various perspectives on a subject – what Q practitioners often call "social discourses" – by having a small number of people with different, but well-formed opinions sort a group of statements according to their personal opinions. Participants in our case study were handed a set of small cards (about the size of a normal business card). Each card had a statement printed upon it that described a single objective that might be important to a spill response. The full list of "Q statements" is given in Table 3.

The statements sorted by the participants were chosen by the research team to represent the fullest possible extent of content relative to the topic.[1] As part of our case studies about the Bouchard-120 and Chalk Point spills we identified objectives that research subjects cared about in those spill responses (see Tuler et al. 2006a, 2006b for more details). We found that many different objectives for the response to these two oil spills were important to our interviewees (although they were not all shared among research subjects in each of the cases). We grouped them into the following broad categories:

- Address needs and concerns of the affected public/communities;
- Establish a coordinated and effective response framework;
- Gain public support for the response;
- Implement an effective and timely response;
- Meet legal and regulatory requirements;
- Mitigate economic impacts;
- Mitigate social nuisance impacts;
- Protect cultural resources;
- Protect environment and mitigate environmental impacts; and
- Protect worker and public health and safety.

In addition, we completed a review of literature about spill response planning (e.g., Baker 1999, Kuchin and Hereth 1999, Ornitz and Champ 2002, Ott 2005, Pond et al. 2000, USCG 2005). We then created statements describing these objectives, by sampling from the quotes we extracted from the interviews and literature. Ultimately, we ended up with 42 statements, as shown in

[1] It is important to note that in a Q study the sample is *not* the people who sort the statements; rather, the sample in a Q study is the set of Q statements, the population is the "concourse" of utterances that have been made on the topic, and the completed Q sorts are the variables. This is just the opposite of standard survey techniques.

Table 3. It was essential that these statements capture the full range of objectives that might be important in any spill response. In other words, we were seeking a set of statements that could be used to study perspectives about spill response objectives in any region.

A condition of instruction specified the context under which the participant was to interpret and react to the Q statements. In both cases the condition of instruction was:

> When you think about past oil spills, what do you think should be the objectives that guide responses to future oil spills in this area? Sort the statements to indicate what you would be *most unlikely to emphasize (-4)* to *most likely to emphasize (+4)* in a future response.

This condition of instruction was designed to focus the participants' thinking on the emergency phases of spill response; we asked them not to consider these objectives in latter response efforts, including restoration and damage assessment. We wanted to draw on each participants' experiences to-date and at the same time get his or her ideas of what would be the most important objectives to guide a response in the future. We did not ask people to evaluate, for example, the Bouchard-120 spill response, although we expected, of course, that their experiences would inform their ideas about a future effort.

This is how the Q sort happened. We asked each participant to read all the statements through once or twice. Then we asked them to sort the statements into three piles, the left-hand pile being the less important ideas, the right-most pile being the most important ideas, and the middle pile being in between. The Q sort was further constrained by forcing participants to sort the cards into a specific pattern. This pattern is shown in Figure 1.[2] Three cards could be placed in the two left-most columns, five in the third column, and so on. The scale was relative, not absolute. In other words, a certain participant may have felt that *all* the statements were important, but he or she still had to differentiate between those that would be *most unlikely* and *most likely* to emphasize.

Participants reported the Q sort was innovative, fun, and that it stimulated their thinking. During the Q sort the researcher asked the participant to talk about the sorting and how he or she interpreted the statements. These comments were recorded and used to help interpret the results.

[2] A question has arisen among researchers using Q methodology about whether the pattern into which people are required to sort the Q statements, such as the normal distribution shown in Figure 1, matters to the results that are obtained. The conclusion among researchers of Q is that the use of a normal distribution makes little or no difference to the results of a study. We elected to use the normal distribution because we find it helps people sort the cards and because it enables us to use software that we prefer.

Figure 1. Layout for Q sort cards.

xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx		xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx		xxxxxxxx	xxxxxxxx	xxxxxxxx	xxxxxxxx
xxxxxxxx	xxxxxxxx	xxxxxxxx				xxxxxxxx	xxxxxxxx	xxxxxxxx
xxxxxxxx	xxxxxxxx						xxxxxxxx	xxxxxxxx
xxxxxxxx	xxxxxxxx						xxxxxxxx	xxxxxxxx
3	**3**	**5**	**6**	**8**	**6**	**5**	**3**	**3**

Most *unlikely* to emphasize

Most *likely* to emphasize

Table 3. List of 42 statements used in the Q sorts.

1) Economic impacts to towns from costs of clean-up should be mitigated.
2) Consumption of contaminated seafood should be prevented.
3) Get on with response efforts early for areas that have been pre-identified as sensitive areas.
4) Even if a species is not native to this area, mitigate impacts to the local population.
5) When faced with a spill, it is most important to protect the adults of a species at risk because the adults can come back next year and reproduce.
6) Give priority to protecting those areas that have multiple resource values, like those that are undeveloped, pristine, and that provide for recreation.
7) Attention should be focused on protecting species that are especially critical for the functioning of an impacted ecosystem.
8) Health and ecological impacts from clean-up activities should be mitigated.
9) The response should remove enough oil so that impacted species, habitats, and local communities can return to the way they were before the spill in a reasonable amount of time.
10) Damage to cultural artifacts (e.g., shipwrecks) from oil and its clean-up should be prevented.
11) Economic impacts from lost recreation should be mitigated.
12) Inconveniences to local residents and tourists should be mitigated.
13) The economic impacts to local commercial fishermen should be reduced, including impacts that might arise from people's perceptions (for example, about shellfish tainting).
14) There should be no situations that threaten human health whatsoever during the response.
15) Costs to the responsible party resulting from the response should be minimized.
16) Getting clean-up contractors on-scene should ramp up quickly, even if there is uncertainty about how many gallons have been spilled.
17) The clean-up should address aesthetic concerns – like oil stains on rocks.
18) Get a good estimate of the amount of oil spilled.
19) Local responders/leaders should be integrated quickly into response planning because of their knowledge of local conditions, resources, etc.
20) Coordination among participating government agencies, contractors, etc. should be established rapidly.
21) Establish meaningful ways of involving volunteers in the response.
22) A well-organized unified command with a clear chain of command should be established.
23) A well-coordinated expert scientific effort should drive the gathering of decision-relevant information, not public concerns and perceptions.
24) Implement the contingency plan.
25) There should be no residual oil or buried oil that is going to show up later.
26) Restoration planning should be tightly integrated with the response effort so that decisions are based on future restoration needs.
27) As much on-water recovery and removal of oil as possible should be achieved.
28) Conduct monitoring of response activities, such as booming, to actually see whether things are working.
29) Clear definitions of what counts as "clean" should be used so that there is a clear end-point.
30) Tell members of the public about the things they want to know about.
31) Responders should listen to the publics' concerns, even if they cannot be addressed to their complete satisfaction.
32) Unified Command should gain public support for the response effort.
33) Unified Command should develop and maintain trust with members of the public.
34) Efforts to communicate with and engage with the community should be proactive and timely.
35) Consistent and accurate information should be provided to the public.
36) Response efforts should direct oil to a "sacrificial area" – such as a sandy cove that will be easier to clean-up than other, more rocky areas.
37) Unified Command should reconcile the preferences and points of views of all parties about what impacts are important to avoid.
38) Unified Command should manage expectations about the clean-up so that they are reasonable.
39) Responsible authorities should assign flexible and experienced decision makers – who can implement contingency plans right away and then step back and ask "what do we need?"
40) Response efforts need to avoid disrupting the integrity and culture of local communities.
41) Subsistence fishing and shellfishing areas should be protected.
42) Make determinations of "clean" with relevant stakeholders, including local residents.

2.4 Q Method Data Analysis

The analysis that is part of Q method reveals both the content of the social discourses present in the group of participants and the extent to which particular individuals believe or subscribe to the different discourses. The assumption is that these social discourses exist partially in the subjectivity of individuals, but they are also a product of social interaction. In addition, while perspectives are held subjectively, similarities among individual views make it possible to articulate a small number of social discourses on a topic.

We arrive at the meaning of each of the social discourses that emerges from the analysis by using three approaches. First of all, Q sort data were entered into a computer program called MQMethod.[3] This program computes the statitical analysis, which is explained in detail below. Second, we recorded the conversation we had with the participant during the sort. We asked the participant to interpret their sort and to explain how he or she interpreted specific Q statements. We used their comments to help interpret the statistical output when composing the perspective narratives. Third, we mailed a narrative description of each social discourse to participants whose individual sorts were most strongly correlated with it. That is, we endeavored to find participants who were most representative of the perspective represented by the social discourse and then asked each of them to verify its clarity, content, and emphasis.

MQMethod is basically a factor analysis program. A factor analysis is a way of identifying a handful of underlying variables that account for changes among a much larger group of measured variables. In both of our cases, the Q sorts are the measured variables and the factor analysis reduced them to three variables, which are called "factors." The program produces factors that are represented as a specific Q sort. The factors identified in the analysis represent "ideal types." Typically, the analysis reveals that each individual's beliefs strongly shares features represented in one factor (which represents a social discourse), and has only moderate to little agreement with the others. In some cases, however, an individual's beliefs may share features of multiple perspectives. The degree to which an individual's beliefs share features with an "ideal" discourse is represented by a score derived as part of the factor analysis. These scores are called "factor loading scores" and a +1.00 would indicate that a participant's sort exactly matched the factor, a 0 would mean there were no similarities at all, and a –1.00 would indicate that a participant's sort was the exact opposite of the factor sort.

Any statistical factor analysis requires a certain amount of judgment in determining the factors. We started every analysis using principle components analysis followed by the varimax solution. Theoretically this solution accounts for the most variance in the data. However, theorists in Q methodology argue that the varimax solution is not necessarily theoretically relevant and that judgmental hand rotation is sometimes needed to find the most appropriate solution. In this case we used judgmental hand rotation because we were able to differentiate individuals more clearly with respect to their factor loading scores and we were able to reduce the number of people who did not load significantly on any factor. We selected our factors based on three criteria when using judgmental hand rotation. First, the solution should account for over 50% of the total variance in the data. Second, the factor had to be meaningful and theoretically important. Third, the number of individuals with multiple significant factor loadings or no significant factor loading was minimized.

Each of the factors represents an idealized social perspective about what is an appropriate process in the context defined by the condition of instruction. The tricky part of the analysis is

[3] This freeware program is available through http://www.qmethod.org. Readers interested in learning more about Q method will find this website informative.

figuring out exactly what each factor means: what perspective, or point of view, is being expressed by those who load significantly on a factor? Based on the arrangement of statements in each of the factors, and with the help of the notes from the conversations, we composed a written narrative describing the particular perspectives represented by each factor. Finally, we validated the narrative's accuracy by emailing high loaders the associated narrative description to them for confirmation.

In the following sections we describe the results for each case separately. Then, we will discuss general findings and observations that emerge from the two Q studies.

3. Spill response objectives in Buzzards Bay, Massachusetts

Three distinct and coherent factors emerged from the analysis; we call these Factors A, B, and C. Each factor represents a perspective on what are the most appropriate objectives for guiding responses to future oil spills in the Buzzards Bay region. Table 4 presents the factor loading scores of each participant and gives the total variance explained by each of the three factors. In the Table we listed subjects according to the factor on which they load most highly. Table 5 presents the inter-factor correlations among the three factors, which shows that they are largely independent of each other. Table 6 presents the rankings of each statement in each of the three factors.

What is particularly important is that every person loaded significantly on at least one factor. Subject 7 loaded significantly on two factors and Subject 12 loaded on all three factors (names are not provided to maintain confidentiality). This suggests that these individuals expressed points of view that are unique and not captured by any of the three "ideal types" emerging from this solution. We investigated other factor solutions, through additional judgmental hand rotation of factors and inclusion of additional factors, but we discovered all the new solutions had more participants confounded on more than one factor, higher inter-factor correlations, and/or less variance explained. Thus, these alternative solutions were not as informative about the differences in preferences among the participants in our study.

Table 4. Factor loadings for Buzzards Bay Q sort participants.
Loadings significant at 95% confidence level when >= .3981. **Bold** font indicates significant loading on a factor.

Subject	Factor A	Factor B	Factor C
Subject 1	**0.8988**	0.1282	0.0873
Subject 2	**0.7926**	0.3017	0.1520
Subject 3	**0.7634**	0.0898	0.0093
Subject 4	**0.7293**	0.1523	0.3260
Subject 5	**0.6869**	0.3799	0.2366
Subject 6	**0.6597**	0.3775	0.2166
Subject 7	**0.5907**	**0.4919**	-0.2437
Subject 8	**0.5550**	0.1970	0.3314
Subject 9	0.0006	**0.8796**	-0.0448
Subject 10	0.2775	**0.7265**	0.0054
Subject 11	0.2308	**0.6181**	0.3890
Subject 12	**0.4269**	**0.5946**	**0.4915**
Subject 13	0.3614	**0.5307**	0.1892
Subject 14	0.3572	**0.5103**	0.3491
Subject 15	0.0276	0.0480	**0.8166**
Subject 16	0.3807	-0.1076	**0.7543**
% variance explained	30%	21%	14%

Table 5. Inter-factor correlations for Buzzards Bay Q study.

	Factor A	Factor B	Factor C
Factor A	1.0000	0.4602	0.3373
Factor B		1.0000	0.1365
Factor C			1.0000

Table 6. Factor array for Buzzards Bay Q study.

Statement	Factor A	Factor B	Factor C
1. Economic impacts to towns from costs of clean-up should be mitigated.	-3	0	-3
2. Consumption of contaminated seafood should be prevented.	0	2	-1
3. Get on with response efforts early for areas that have been pre-identified as sensitive areas.	2	3	-1
4. Even if a species is not native to this area, mitigate impacts to the local population.	-2	-2	0
5. When faced with a spill, it is most important to protect the adults of a species at risk because the adults can come back next year and reproduce.	-1	0	0
6. Give priority to protecting those areas that have multiple resource values, like those that are undeveloped, pristine, and that provide for recreation.	3	0	3
7. Attention should be focused on protecting species that are especially critical for the functioning of an impacted ecosystem.	1	2	4
8. Health and ecological impacts from clean-up activities should be mitigated.	1	2	0
9. The response should remove enough oil so that impacted species, habitats, and local communities can return to the way they were before the spill in a reasonable amount of time.	0	1	1
10. Damage to cultural artifacts (e.g., shipwrecks) from oil and its clean-up should be prevented.	-2	-1	-2
11. Economic impacts from lost recreation should be mitigated.	-3	-1	-1
12. Inconveniences to local residents and tourists should be mitigated.	-2	-1	-3
13. The economic impacts to local commercial fishermen should be reduced, including impacts that might arise from people's perceptions (for example, about shellfish tainting).	-1	0	-2
14. There should be no situations that threaten human health whatsoever during the response.	2	4	-4
15. Costs to the responsible party resulting from the response should be minimized.	-4	-4	-4
16. Getting clean-up contractors on-scene should ramp up quickly, even if there is uncertainty about how many gallons have been spilled.	3	3	0
17. The clean-up should address aesthetic concerns – like oil stains on rocks.	-4	-3	-4
18. Get a good estimate of the amount of oil spilled.	-1	0	2
19. Local responders/leaders should be integrated quickly into response planning because of their knowledge of local conditions, resources, etc.	4	1	4
20. Coordination among participating government agencies, contractors, etc. should be established rapidly.	4	2	-1
21. Establish meaningful ways of involving volunteers in the response.	-2	1	0
22. A well-organized unified command with a clear chain of command should be established.	4	4	0
23. A well-coordinated expert scientific effort should drive the gathering of decision-relevant information, not public concerns and perceptions.	2	-2	2
24. Implement the contingency plan.	0	3	-1
25. There should be no residual oil or buried oil that is going to show up later.	-4	1	1
26. Restoration planning should be tightly integrated with the response effort so that decisions are based on future restoration needs.	-1	-1	3

27. As much on-water recovery and removal of oil as possible should be achieved.	2	4	2
28. Conduct monitoring of response activities, such as booming, to actually see whether things are working.	1	1	4
29. Clear definitions of what counts as "clean" should be used so that there is a clear end-point.	-1	1	2
30. Tell members of the public about the things they want to know about.	-1	-3	-2
31. Responders should listen to the publics' concerns, even if they cannot be addressed to their complete satisfaction.	0	-2	1
32. Unified Command should gain public support for the response effort.	0	-1	-2
33. Unified Command should develop and maintain trust with members of the public.	1	-4	2
34. Efforts to communicate with and engage with the community should be proactive and timely.	1	0	0
35. Consistent and accurate information should be provided to the public.	1	-2	3
36. Response efforts should direct oil to a "sacrificial area" – such as a sandy cove that will be easier to clean-up than other, more rocky areas.	2	-4	1
37. Unified Command should reconcile the preferences and points of views of all parties about what impacts are important to avoid.	0	-2	-1
38. Unified Command should manage expectations about the clean-up so that they are reasonable.	0	0	-2
39. Responsible authorities should assign flexible and experienced decision makers – who can implement contingency plans right away and then step back and ask "what do we need?"	3	-1	-3
40. Response efforts need to avoid disrupting the integrity and culture of local communities.	-3	-3	0
41. Subsistence fishing and shellfishing areas should be protected.	0	2	1
42. Make determinations of "clean" with relevant stakeholders, including local residents.	-2	0	1

In the following sections we present the three perspectives that are represented by Factors A, B, and C via narratives that describe the kinds of objectives that should guide spill response in the Buzzards Bay region. Since the narratives are constructed from the Q statements references to important Q statements are included in the descriptions.

Buzzards Bay Factor A:

The perspective represented by this factor emphasizes the need for establishing a coordinated and effective response structure that focuses on protection of ecological resources.

The four most highly ranked statements in this factor relate to establishing clear roles and coordination among responders. Coordination among response organizations is critical (20) and local responders should be integrated quickly into the response effort (19). There should be a well-organized unified command with a clear chain of command (22) that is lead by individuals with experience and flexibility (19). In this perspective it is not as important to implement the contingency plan (24) as it is to be responsive to the situation. This responsiveness can be improved by using a well-coordinated expert scientific effort to drive the gathering of decision-relevant information, not public concerns and perceptions (23).

Another theme that receives emphasis in this factor is that response should proceed quickly. Clean-up contractors should be directed to the scene quickly, even if there is uncertainty about how many gallons have been spilled (16) and responders should get on with response efforts early for areas that have been pre-identified as sensitive areas (3). Furthermore, as much on-water recovery and removal of oil as possible should be achieved (27).

While the response should be rapid, it should also be strategic. It is important to focus on sensitive ecological resources (3, 6, 7, 36, not 4). In particular, the response should give priority to protecting those areas that have multiple resource values, like those that are undeveloped, pristine, and that provide for recreation (6) and where possible the response efforts should direct oil to a "sacrificial area" – such as a sandy cove that will be easier to clean-up than other, more rocky areas (36). Moreover, it is important that there should be no situations that threaten human health whatsoever during the response (14), and efforts should also be attentive to protecting public health (2, 8).

The perspective represented by this factor does not place a high degree of emphasis on how the spill or response might affect local communities. When we validated a draft narrative for this factor, one respondent noted that this is particularly true for the initial *emergency* phase of spill response. During the early stages of a spill response it would, for example, be a low priority to minimize inconveniences to local communities and residents (11, 40) or to involve untrained residents in emergency clean-up activities when those activities may pose health risks. Similarly, it would be a low priority at such moments in a spill response to minimize economic impacts to towns from costs of clean-up (1, 11, 13), mitigate aesthetic impacts and concerns about residual oil (17, 25); and mitigate socio-cultural impacts, such as to subsistence fishing (41) and the integrity and culture of local communities (40). Nor would it be important to involve local residents in the emergency phases of a response effort. There is no support for making determinations of "clean" with relevant stakeholders, including local residents (42) or establishing meaningful ways of involving volunteers in the response (21). On the other hand, many of these could become very important in latter phases of spill response, including damage assessment and restoration.

Buzzards Bay Factor B:

The perspective represented by Factor 2 emphasizes two themes. There should be a well-coordinated response that is driven by the contingency plan and the response should emphasize protection of public health and ecological resources. The former improves the likelihood that the second will be achieved.

Establishing a well-organized unified command with a clear chain of command (22) is the most highly ranked objective in this factor. The Unified Command should implement the contingency plan (24). Because response managers are following the contingency plan, there is an idea that responsible authorities should assign flexible and experienced decision-makers who can implement contingency plans right away and then step back and ask "what do we need?" (39). Having a well-coordinated expert scientific effort to drive the gathering of decision-relevant information (23) and setting up mechanisms for Unified Command to reconcile the preferences and points of views of all parties about what impacts are important to avoid (37) are de-emphasized in the midst of a response. There is ambivalence about the role of local responders (19) and volunteers (21).

A second, very important theme that is emphasized in this perspective is that the response should not put people or resources at further risk. There should be no situations that threaten human health whatsoever during the response (14). Furthermore, health and ecological

impacts from clean-up activities should be mitigated (8). This perspective also emphasizes *preventing* damage as much as possible:

- As much on-water recovery and removal of oil as possible should be achieved (27);
- Get on with response efforts early for areas that have been pre-identified as sensitive areas (3);
- Getting clean-up contractors on-scene should ramp up quickly, even if there is uncertainty about how many gallons have been spilled (16);
- Consumption of contaminated seafood should be prevented (2); and
- Subsistence fishing and shell-fishing areas should be protected (41).

On the other hand, there is little belief that the spilled oil can be 'managed' by responders. For example, loaders on this perspective are unlikely to emphasize that response efforts should direct oil to a "sacrificial area" – such as a sandy cove that will be easier to clean-up than other, more rocky areas (36).

Those loading on this factor are also unlikely to emphasize objectives related to risk communication; while this is also the case for Factor A, this issue is more strongly de-emphasized in Factor B. For example, they ranked the following objectives low :

- Unified Command should develop and maintain trust with members of the public (33);
- Tell members of the public about the things they want to know about (30);
- Responders should listen to the publics' concerns, even if they cannot be addressed to their complete satisfaction (31);
- Consistent and accurate information should be provided to the public (35); and
- Efforts to communicate with and engage with the community should be proactive and timely (34).

Buzzards Bay Factor C:

The perspective represented by this factor emphasizes the ways that Unified Command's response effort is coordinated and integrated with a larger context of activities, such as local responders, and monitoring and restoration. By being part of the 'big picture' in which response is embedded response to oil spills can be improved.

This factor emphasizes a set of objectives related to the performance of the response system. Decisions should be driven by good information, and not necessarily by the area contingency plan (24) or public perceptions (23). Local responders/leaders should be integrated quickly into response planning because of their knowledge of local conditions, resources, etc. (19). A concern with gathering and using relevant information is complemented by the emphasis given to the objective that a well-coordinated expert scientific effort should drive the gathering of decision-relevant information (23) and the need to get a good estimate of the amount of oil spilled (18). Furthermore, it is important that monitoring of response activities be conducted, such as booming, to actually see whether things are working (28) and that response be informed by the needs of restoration (26).

There is an underlying sense, among those that load highly on this perspective, that damage from oil is inevitable, even while recovery of oil on the water is desired (27). Thus, it is important that there be clear definitions of what counts as "clean" should be used so that there is a clear end-point (29) and responders consider directing oil to a "sacrificial area" – such as a sandy cove that will be easier to clean-up than other, more rocky areas (36).

The aim of the response effort should focus on protecting species that are especially critical for the functioning of an impacted ecosystem (7) and on protecting those areas that have multiple resource values, like those that are undeveloped, pristine, and that provide for recreation (6). They want to do this even if this means having people experience some kinds of harm (8, 14); while it may be responsible during emergency response to allow people to experience temporary loss of areas for recreation or commerce, it would never by acceptable to put lives at risk. Mitigation of economic impacts, inconveniences to local people and tourists, cultural resources, and aesthetics are relatively unimportant compared to other more highly ranked objectives during the emergency response phase, as suggested by the low rankings for a number of statements having to do with these possible objectives (1, 11, 12, 13, 15, 17).

Those that ascribe to the factor represented by this perspective also emphasize some objectives related to public communication. Provision of consistent and accurate information to the public is very important (35). On the other hand, the objective to tell members of the public about the things they want to know about (30) is not emphasized. Moreover, those who load on this factor do not emphasize objectives for managing public expectations (38) or gaining public support for the response effort (32) – even while they want to gain their trust (33).[4]

Discussion of Buzzards Bay results

Each of the three factors represents a distinct view about the relative importance of objectives that should guide oil spill response in Buzzards Bay. Of course, these factors share some features, while still having some important differences.

Factor A highlights the need for a well-organized response system. It should ensure good coordination (20), integrate local responders (19), have a clear chain of command (22), get clean-up crews on-site rapidly (16), and initiate efforts rapidly (3). On the other hand, objectives related to economic costs (1, 11), aesthetic concerns (17), and inconveniencing local residents (12, 40) were ranked low. Objectives related to public health and ecological impacts were important (2, 8, 7, 6, 36, 14) but not as important as objectives related to response organization – nor did they receive the same relative emphasis as they did in Factors B or C.

Objectives that are articulated in policy (e.g., National Response Plan) were rated high in Factor B (statements 14, 2, 7, 8, 41); these are the statements regarding protection of public and worker health and that special attention should be focused on protecting species that are especially critical for the functioning of an impacted ecosystem. In addition, those loading highly on this factor placed a high priority on implementing the contingency plan (24); Factor A, instead, rates more highly the need for people that can be flexible (39). This factor also shares the concern that there be a clear chain of command (22), that as much oil as possible be recovered off-shore (27), and the need for the ramping up response quickly (16). Factor B does not represent a perspective that places a high premium on science to guide the response effort (23), relative to Factor A or C. The importance of flexible leadership (39), coordination (20), and integration of local responders (19) are all ranked much lower than for Factor A.

[4] When we validated a draft of this narrative with an individual who loaded highly on Factor C we were told that "Managing public expectations is one of the more critical elements of an effective spill response. In general, the public has inflated expectations of the efficacy of current spill response technologies. No response, no matter how well conducted, will pick up every oiled bird or return every oiled marsh and beach to it's pre-spill condition (at least not in the near term). It is important that the public hear that message early and often." Nevertheless, in this Factor statement #38 was ranked very low (z-score equal to -1.161).

The perspective represented by Factor C rates some issues with a different priority than the other two factors. Monitoring of activities (28), providing accurate and consistent information to the public (35), and integrating restoration planning with clean-up activities (26) are much more important in this factor. However, Factor C shares with Factor A the objective for good local responder integration into the effort (19); this may be a result of conflicts that arose among federal, state, and local responders about the notification and integration of local first responders immediately after the spill occurred (see Tuler et al. 2006a). Their concerns about impacts are mostly focused on ecological impacts (7, 6). They are unconcerned about threats to public health (14), as well as aesthetic concerns (17), costs to the responsible party (15), inconveniences to local residents (12), and costs to local towns (1). Science as a guide to decisions is most important in this perspective (23).

This brief overview has focused on the relative rankings that particular statements received in each of the three factors. In Table 7 we compare the relative emphasis that is given by each of the three factors to the different types of objectives; these objectives were found to be important in our case studies of the Bouchard-120 and Chalk Point spills and they were the primary basis for the selection of the Q statements. In addition, we have included two other statements for comparison:

- Implement the contingency plan.
- A well-coordinated expert scientific effort should drive the gathering of decision-relevant information, not public concerns and perceptions.

For each type of objective the z-scores of the statements associated with that objective were summed. Z-scores are a measure of the relative importance of a statement in a Factor. These data, then, reveal the relative importance of a particular objective across the three factors. The data also provide some information about the relative importance of different types of objectives within a particular factor. However, these data should be used cautiously, as a) there are different numbers of statements that define each objective and b) z-scores can be both positive and negative, so that sums of z-scores can mask how some statements are ranked relative to others (e.g., statement #35 is ranked highly in Factor C, although all of the other statements relating to the objective of addressing public concerns are emphasized more weakly).

Table 7. Summed z-scores for statements defining types of objectives in the Buzzards Bay case.

Type of objective	Factor A	Factor B	Factor C
Protect worker and public health and safety	1.555	4.753	-1.678
Protect environment and mitigate environmental impacts	2.412	4.274	2.968
Mitigate economic impacts	-5	-2.198	-4.474
Protect cultural resources	-1.874	-1.468	-0.43
Mitigate social nuisance impacts	-2.954	-1.987	-3.011
Gain public support for the response	0.071	-2.048	-0.172
Address needs and concerns of the affected public/communities	-0.638	-4.813	-0.602
Establish a coordinated and effective response framework	6.53	5.253	2.968
Implement an effective and timely response	6.135	4.157	0.904
Implement the contingency plan.	0.268	1.394	-0.602
A well-coordinated expert scientific effort should	0.832	-0.943	0.99

drive the gathering of decision-relevant information, not public concerns and perceptions.			

Inspite of these caveats, the data in Table 7 reveal important similarities and differences among the factors:

- Factors A and B place much more emphasis on the coordination and timeliness of the response effort, relative to Factor C;
- Mitigating economic impacts are relatively unimportant compared to mitigating ecological impacts;
- Addressing public concerns or gaining public support are much less of a priority in Factor B then in the other two factors;
- Factor B places more emphasis on following the contingency plan than Factors A or C; and
- Having a well-coordinated and expert scientific effort that drives the gathering of decision-relevant information is important in Factors A and C, but not in Factor B.

These differences cannot be simply attributed to the affiliations of the individuals who load highly on the various factors:

- Almost all of the local responders included in our sample of research subjects loaded highly on Factor A;
- Both federal officials *and* local residents loaded highly on Factor B; and
- Factor C represents a perspective that includes a federal official and an NGO environmental advocate.

4. Spill response objectives in San Francisco Bay, California

Three distinct and coherent factors emerged from the analysis; we call these Factors D, E, and F. Each factor represents a perspective on what are the most appropriate objectives for guiding responses to future oil spills in the San Francisco Bay region. Table 8 presents the factor loading scores of each participant and gives the total variance explained by each of the three factors. In the Table we listed subjects according to the factor on which they load most highly. Table 9 presents the inter-factor correlations among the three factors, which shows that they are largely independent of each other. Table 10 presents the rankings of each statement in each of the three factors.

What is particularly important is that every person loaded significantly on at least one factor. Subject 8 loaded significantly on two factors (names are not provided to maintain confidentiality); one loading was *negative*, however, suggesting substantial disagreement with the second factor (E). In addition, Factors E and F are each defined by a single individual. We investigated other factor solutions, through additional judgmental hand rotation of factors and inclusion of additional factors, but we discovered all the new solutions had more participants confounded on more than one factor, higher inter-factor correlations, and/or less variance explained. Thus, these alternative solutions were not as informative about the differences in preferences among the participants in our study.

Table 8. Factor loadings for San Francisco Bay Q sort participants.
Loadings significant at 95% confidence level when >= .3981. **Bold** font indicates significant loading on a factor.

Subject	Factor D	Factor E	Factor F
Subject 1	**0.8536**	0.0405	0.1308
Subject 2	**0.8388**	-0.1359	0.2181
Subject 3	**0.8338**	0.2543	-0.2806
Subject 4	**0.8075**	-0.1688	-0.1034
Subject 5	**0.7938**	0.0952	0.0954
Subject 6	**0.7936**	0.1327	0.2093
Subject 7	**0.7796**	-0.1721	-0.1147
Subject 8	**0.7086**	**-0.4414**	-0.0961
Subject 9	**0.6714**	0.0106	0.3167
Subject 10	**0.6657**	0.0074	0.0405
Subject 11	**0.6625**	0.3489	0.2179
Subject 12	0.2439	**0.8594**	0.0767
Subject 13	0.3547	-0.2139	**0.8535**
% variance explained	51%	10%	9%

Table 9. Inter-factor correlations for San Francisco Bay Q study.

	Factor D	Factor E	Factor F
Factor D	1.0000	0.2431	0.3996
Factor E		1.0000	0.0099
Factor F			1.0000

Table 10. Factor array for San Francisco Bay Q study.

	Factor D	Factor E	Factor F
1. Economic impacts to towns from costs of clean-up should be mitigated.	-2	0	0
2. Consumption of contaminated seafood should be prevented.	1	2	2
3. Get on with response efforts early for areas that have been pre-identified as sensitive areas.	3	0	1
4. Even if a species is not native to this area, mitigate impacts to the local population.	-4	-1	-4
5. When faced with a spill, it is most important to protect the adults of a species at risk because the adults can come back next year and reproduce.	-1	2	-2
6. Give priority to protecting those areas that have multiple resource values, like those that are undeveloped, pristine, and that provide for recreation.	1	0	0
7. Attention should be focused on protecting species that are especially critical for the functioning of an impacted ecosystem.	2	4	4
8. Health and ecological impacts from clean-up activities should be mitigated.	0	-1	2
9. The response should remove enough oil so that impacted species, habitats, and local communities can return to the way they were before the spill in a reasonable amount of time.	2	3	4
10. Damage to cultural artifacts (e.g., shipwrecks) from oil and its clean-up should be prevented.	-1	-1	2
11. Economic impacts from lost recreation should be mitigated.	-3	-1	3
12. Inconveniences to local residents and tourists should be mitigated.	-3	-2	0
13. The economic impacts to local commercial fishermen should be reduced, including impacts that might arise from people's perceptions (for example, about shellfish tainting).	-2	4	2
14. There should be no situations that threaten human health whatsoever during the response.	4	-3	1
15. Costs to the responsible party resulting from the response should be minimized.	-4	-3	-3
16. Getting clean-up contractors on-scene should ramp up quickly, even if there is uncertainty about how many gallons have been spilled.	4	1	0
17. The clean-up should address aesthetic concerns – like oil stains on rocks.	-4	-3	-2
18. Get a good estimate of the amount of oil spilled.	0	2	-1
19. Local responders/leaders should be integrated quickly into response planning because of their knowledge of local conditions, resources, etc.	2	2	1
20. Coordination among participating government agencies, contractors, etc. should be established rapidly.	3	1	1
21. Establish meaningful ways of involving volunteers in the response.	-3	0	-4
22. A well-organized unified command with a clear chain of command should be established.	4	3	1
23. A well-coordinated expert scientific effort should drive the gathering of decision-relevant information, not public concerns and perceptions.	1	4	-1
24. Implement the contingency plan.	3	-4	1
25. There should be no residual oil or buried oil that is going to show up later.	-2	-4	4
26. Restoration planning should be tightly integrated with the response effort so that decisions are based on future restoration needs.	-1	0	-3
27. As much on-water recovery and removal of oil as possible should be achieved.	2	-4	3
28. Conduct monitoring of response activities, such as booming, to actually see whether things are working.	1	1	3

29. Clear definitions of what counts as "clean" should be used so that there is a clear end-point.	0	3	0
30. Tell members of the public about the things they want to know about.	-2	-2	0
31. Responders should listen to the publics' concerns, even if they cannot be addressed to their complete satisfaction.	-1	-1	-1
32. Unified Command should gain public support for the response effort.	-1	-1	-1
33. Unified Command should develop and maintain trust with members of the public.	0	-2	-1
34. Efforts to communicate with and engage with the community should be proactive and timely.	1	0	-1
35. Consistent and accurate information should be provided to the public.	0	-2	0
36. Response efforts should direct oil to a "sacrificial area" – such as a sandy cove that will be easier to clean-up than other, more rocky areas.	0	1	-2
37. Unified Command should reconcile the preferences and points of views of all parties about what impacts are important to avoid.	0	1	-2
38. Unified Command should manage expectations about the clean-up so that they are reasonable.	1	2	-4
39. Responsible authorities should assign flexible and experienced decision makers – who can implement contingency plans right away and then step back and ask "what do we need?"	2	0	0
40. Response efforts need to avoid disrupting the integrity and culture of local communities.	-1	0	-3
41. Subsistence fishing and shellfishing areas should be protected.	0	-2	2
42. Make determinations of "clean" with relevant stakeholders, including local residents.	-2	1	-2

In the following sections we present the three perspectives that are represented by Factors D, E, and F via narratives that describe the kinds of objectives that should guide spill response in the San Francisco Bay region. Since the narratives are constructed from the Q statements, references to important Q statements are included in the descriptions.

San Francisco Bay Factor D:

This factor represents a perspective that emphasizes the need to rapidly establish an effective organization to implement response actions. Response actions should be guided, initially, by the contingency plan. A quick response, however, should in no way put people at risk (14).

This overall goal is facilitated through the achievement of several objectives. The most highly ranked statement in this perspective is that a well-organized unified command with a clear chain of command should be established (22). Clarity about roles and responsibilities is critical. In addition, objectives ranked highly are for getting clean-up contractors on-scene quickly (16), implementing the contingency plan (24), ensuring coordination among multiple responsible government agencies and organizations (20), and integrating local responders and leaders into response efforts (19). Of course, contingency plans should not be followed blindly: Responsible authorities should assign flexible and experienced decision-makers who can implement contingency plans right away and then step back and ask "what do we need?" (39).

In addition to the paramount objective of not putting people at risk during the response (14), a well-organized response system should be oriented toward protecting critical ecological systems. There should be rapid efforts to protect areas that have been pre-identified as sensitive (3, 24) and attention should be focused on protecting species that are especially critical for the functioning of an impacted ecosystem (7). The ability to protect ecological systems is enhanced by on-water recovery and removal of oil (27). In any case, the response

should remove enough oil so that impacted species, habitats, and local communities can return to the way they were before the spill in a reasonable amount of time (9). This concern is not extended to non-native species (4).

People ascribing to the perspective represented by this factor are unlikely to emphasize objectives related to the concerns or needs of impacted human communities.[5] For example, objectives related to mitigating aesthetic, social, or economic impacts to local communities (17, 12, 11, 1, 13, 40, 25) were ranked low. Furthermore, it is not a high priority to involve local communities in response efforts (21, 42) or to inform them about the response efforts (30). Loaders on this perspective are also unlikely to emphasize the objective of minimizing costs to the responsible party resulting from the response (15).

San Francisco Bay Factor E:
This factor represents a perspective that emphasizes mitigation of long-term impacts to coupled human and environment systems. The emphasis should be on mitigating impacts to "foundational" components of the human-environment system, including fisheries and markets.

Protection of ecological systems is very important to this perspective. The most highly ranked statement is that attention should be focused on protecting species that are especially critical for the functioning of an impacted ecosystem (7). In this context, that can mean, for example, plankton which are important because they are the base of the food chain. In addition, a response effort should protect the adults of a species at risk because the adults can come back next year and reproduce (5).

In addition, it is very important that critical components of regional human systems be protected. This means that economic impacts to local commercial fishermen should be reduced (13), enough oil be removed so that communities and can recover (9) and consumption of contaminated seafood is prevented (2). At the same time, it is not very important that the response be driven by a concern for subsistence or recreational fishing and shell-fishing (41, 11) or inconveniences to tourists (12), because these are not significant elements of the regional economy or culture.

Efforts to protect coupled human and environment systems are enhanced when objectives related to the organization of the response effort and basis for decisions are attended to. It is critically important for there to be a well-coordinated response (23, 22, 19) that utilizes good information (23, 18, 19) has clear decision criteria (29), and is flexible (24; response managers should not just do what is specified in the contingency plan).

This means that the response effort should not be driven by public concerns or perceptions (17, 23, 33), and that Unified Command has the responsibility to manage expectations about the clean-up so that they are reasonable (38). Consequently, a priority of managers should *not* be to achieve as much on-water recovery and removal of oil as possible (27) because that could

[5] When validating a draft narrative for this perspective one person commented that "think the relegation of local community involvement to "low priority" is 1) an artifact of the exercise (i.e., only a certain number of cards could be allocated to each rank), 2) local community involvement had been already been included via area contingency planning, and 3) some of us DID put at least one card involving public/media/community outreach by the unified command (and there were several cards that touched on this) in the first five ranks." While all of these reasons may have some validity for specific individuals loading on this factor, as an "ideal" Q sort representing the largest group of respondents the relative emphasis given to these statements is low.

require the use of dispersants which might harm plankton and diatoms that are important to the health of fisheries – it would be better to see oil on rocks and lose a few birds than use dispersants that could affect entire fisheries. Similarly, the elimination of residual or buried oil (25) may cause more problems than are solved: the objective should be to focus on higher order objectives of ecosystem functioning and not have the response be driven by, for example, aesthetics (17). In addition, those ascribing to this perspective are unlikely to emphasize avoiding *all* situations that threaten human health whatsoever during the response (14) – oil spill response is inherently risky and this objective would be a "show stopper."

San Francisco Bay Factor F:

The perspective represented by this factor is very focused on mitigating impacts to ecological resources. The entire response should be guided by this overall goal, including organizational and management objectives.

Protection of ecological systems is paramount. The response should focus on protecting species that are especially critical for the functioning of an impacted ecosystem (7), but not on species not native to the area (4). The aim should be for the response to remove enough oil so that impacted species, habitats, and local communities can return to the way they were before the spill in a reasonable amount of time (9). Mitigation of impacts to important regional economic activities, such as recreation (11, 10) and sale of seafood (2, 13, 41), are also important objectives – but secondary to protection of the ecological resources.

Mitigation of impacts and promotion of long-term recovery are enhanced when a) no residual oil or buried oil is going to show up later (which may exacerbate impacts) (25) and b) oil is recovered and removed while off-shore (27). However, there is little credence given to the idea that oil can be *purposefully* directed to "sacrificial" areas as an impact mitigation strategy (36). Usually the people that must make such a decision in the field lack ecological expertise. In other words, response actions can cause more harm than good.

It is also important to ensure that response efforts are actually working, so that new strategies can be developed if necessary. This means response activities should be monitored (28) and responders should be guided by, but not get locked into, contingency plans (24). Moreover, it is important to allow response managers to focus on critical tasks. They should not be side-tracked by managing volunteers (21) or public opinion (38), resolving conflicts about preferences and points of views of all parties (37, 42), or addressing aesthetic concerns (17). Similarly, because those who load on the factor that represents this perspective do not believe that it is difficult to coordinate response activities with restoration planning (26), it is not emphasized as an important objective.

Finally, oil spills and responses to them involve risks. It is not possible to respond in a way that puts *no* responders at risk (14). Nor is it reasonable to avoid disrupting the integrity and culture of local communities (40) – responses are by their very nature disruptive. It is also not an important objective to minimize costs to the responsible party (15).

Discussion of San Francisco Bay results

Each of the three factors represents a distinct view about the relative importance of objectives that should guide oil spill response in San Francisco Bay. Of course, these factors share some features, while still having some important differences.

Factor D emphasizes very strongly (relative to the other two factors) the need for a well-organized response system. It should ensure good coordination (20), integrate local responders

(19), have a clear chain of command (22), get clean-up crews on-site rapidly (16), and initiate efforts rapidly (3). On the other hand, objectives related to mitigating impacts to human systems were ranked low (1, 11, 12, 13, 17, 40). Objectives related to ensuring public and worker health and safety and to mitigating ecological impacts were ranked as important in this factor; most emphasis is given to protecting key species and sensitive areas that have been identified during pre-spill planning (3, 24, 7).

The concern for mitigating impacts to ecological systems is shared by Factors E and F as well. But this general statement can mask some important differences in the perspectives that the factors represent. In particular, Factor E represents a view that mitigation of impacts is not only a function of the amount of oil that is removed or remains. It is also a function of *how* the oil is removed. Thus, for example, it might be better to avoid using dispertants or *insitu* burning. Furthermore, there is additional emphasis on the need to protect adults of a species that can continue to reproduce in the following years (5). Interestingly, this also appears to have an influence on the relative importance of worker and public safety in the overall response effort: those loading on Factor E believe that oil spill response is inherently risky so that avoiding *all* situations that threaten human health whatsoever during the response (14) is not a reasonable objective.

In addition, Factors E and F also place a strong emphasis on the need to protect the human components of the impacted region (e.g., statement 13). This issue does not emerge as a strong concern in Factor D. Those ascribing to Factor E express concern with long-term impacts that may result from "hidden" changes; such as those to lower levels in the food chain that may cause negative impacts to resources that are important ecologically and economically (commercial fisheries). That is why Factor E does not emphasize that there should be as much on-water recovery and removal, as this can require use of dispersants that harm plankton (27) or that there should be no residual oil or buried oil (25). This is also suggested by Factor E's emphasis on reducing economic impacts to local fishermen (13).

Those who load on Factors E and F give more emphasis to the objective that the response should remove enough oil so that impacted species, habitats, and local communities can return to the way they were before the spill in a reasonable amount of time (9). Again, this reflects their concern with the impacts to human components of the impacted region (i.e., local economies, culture). Factor F appears to place somewhat more emphasis on avoiding potential impacts to recreation (11, 12) – which can be important to the local economy – and to subsistence fishing (41), relative to Factor E. This may be because those individuals who load on Factor E have a different sense of the importance of these than do those who load highly on Factor F.

Finally, the way that decisions about response actions are made is another area of significant disagreement between Factors D and E. Those ascribing to Factor D believe that the response should closely follow the contingency plan (24), while at the same time having leadership that is flexible and experienced (39). Those ascribing to Factor E suggest that the contingency plan should not be implemented blindly. Case specific contingencies need to be accounted for, and the best way to do this is with a well coordinated expert scientific effort (23) and clear definitions of what end-points are desired (29); these end-points may not be clearly spelled out in the contingency plan. It is better to have responders who ask: what do we need here? Now?

This brief overview has focused on the relative rankings that particular statements received in each of the three factors. In Table 11 we compare the relative emphasis that is given by each of the three factors to the different types of objectives; these objectives were found to be

important in our case studies of the Bouchard-120 and Chalk Point spills and they were the primary basis for the selection of the Q statements. In addition, we have included two other statements for comparison:

- Implement the contingency plan.
- A well-coordinated expert scientific effort should drive the gathering of decision-relevant information, not public concerns and perceptions.

For each type of objective the z-scores of the statements associated with that objective were summed. Z-scores are a measure of the relative importance of a statement in a Factor. These data, then, reveal the relative importance of a particular objective across the three factors. The data also provide some information about the relative importance of different types of objectives within a particular factor. However, these data should be used cautiously, as a) there are different numbers of statements that define each objective and b) z-scores can be both positive and negative, so that sums of z-scores can mask how some statements are ranked relative to others (e.g., statement #38 is ranked highly in Factor E, although all of the other statements relating to the objective of addressing public concerns are emphasized more weakly).

Table 11. Summed z-scores for statements defining types of objectives in the San Francisco Bay case.

Type of objective	Factor D	Factor E	Factor F
Protect worker and public health and safety	1.879	-1.803	3.154
Protect environment and mitigate environmental impacts	3.312	3.604	4.055
Mitigate economic impacts	-4.82	-0.001	0.901
Protect cultural resources	-1.031	-0.451	-0.451
Mitigate social nuisance impacts	-3.407	-2.253	-0.901
Gain public support for the response	-0.639	-1.352	-0.902
Address needs and concerns of the affected public/communities	-1.501	-0.45	-4.506
Establish a coordinated and effective response framework	7.681	1.353	2.254
Implement an effective and timely response	5.48	1.803	1.353
Implement the contingency plan.	1.657	-1.802	0.451
A well-coordinated expert scientific effort should drive the gathering of decision-relevant information, not public concerns and perceptions.	0.087	1.802	-0.451

Inspite of these caveats, the data in Table 11 reveal important similarities and differences among the factors:

- Factor D places much more emphasis on the coordination and timeliness of the response effort, relative to Factors E and F;
- Factor D places more emphasis on following the contingency plan than Factors E or F;
- Mitigating economic impacts are relatively unimportant compared to mitigating ecological impacts in Factors D. Factor E gives significant weight to the objective that the economic impacts to local commercial fishermen should be reduced, including impacts that might arise from people's perceptions (for example, about shellfish tainting) (13),

while Factor F gives significant weight to this objective as well as the objective that economic impacts from lost recreation should be mitigated (11);

- Addressing public concerns or gaining public support receive little emphasis in all three factors, but especially so in Factor F. Objectives related to public communication, trust, support, etc. are ranked as mid to low level of importance in all factors. These are statements 30, 31, 32, 33, 34, 35, 37, 38, 42. As one person completing the Q sort stated, "why do responders care about trust from the public? Does it help clean up the oil? No…the public is not so critical to getting the job done;'" and
- Having a well-coordinated and expert scientific effort that drives the gathering of decision-relevant information is important in Factor E, but not in Factors D or F.

These differences cannot be simply attributed to the affiliations of the individuals who load highly on the various factors. 11 out of 13 of the individuals completing the Q sorts about San Francisco Bay loaded on Factor D. Only one person each loaded on Factors E (a local fisherman) and F (a state NRDA specialist).

It is interesting to speculate on why this may be so. At the start it is important to note that this may be an artifact of the individuals we had complete the Q sorts. We may not have chosen a very good sample to represent the diversity of perspectives about relative importance of objectives that should inform response in this region. While we asked the regional NOAA SSC for input about whom to contact, we should not expect that he would have knowledge of people's specific points of view.

On the other hand, the degree of consensus may in fact be real. A high level of consensus about objectives may be a result of recent planning efforts in this region, such as the 2000 ecological risk assessment (Pond et al. 2000). However, this claim must be balanced against the information that only *two* of the participants in our research attended workshops for the ecological risk assessment (see Pond et al., 2000 Appendix A); both of these were high loaders on Factor D. We do not know how the fact that many of the others involved in our study work at the agencies and organizations whose representatives participated in the ecological risk assessment affects the perspectives expressed to us via the Q sorts.

In addition, there has been no recent large scale oil spill in this region that would raise questions about the contingency plan and general agreement about objectives. Such disjunctures have been discussed in the literature on disaster planning and hazard management. For example, Clarke (1999, pg. 2) has written, with one of his case studies about the Exxon Valdez response, that "organizations and experts use plans as forms of rhetoric, tools designed to convince audiences that they ought to believe what an organization says. In particular, some plans have so little instrumental utility in them that they warrant the label 'fantasy document.'" This is, in fact, the critique of the high loader on Factor E. Without making too strong a claim about the adequacy of the contingency plan for San Francisco Bay (which we did not attempt to evaluate in any way), we also note that in a region like southern New England where there have been two more recent large spills (Naragansett and Buzzards Bays), any consensus that might have emerged from the planning process (contingency planning) may have been ruffled by actual experiences – such as integration of local responders into the response effort (as reflected in factor loadings for the Buzzards Bay case).

At the same time, we cannot discount Factors E and F as unimportant or marginal, although each of these factors is only defined by a single individual. However, because we used Q method we do not know anything about the relative frequencies of the perspectives represented by the factors in the population.

5. Discussion

The perspectives that emerge about oil spill response objectives from the two cases reflect the over-arching goals of oil spill response as articulated in federal policy guidance:

1. Maintain safety of human life;
2. Stabilize the situation to preclude it from worsening (e.g., through a well-run and rapid response that seeks to remove oil before it reaches shore), and
3. Minimize adverse environmental and socioeconomic impacts by coordinating all containment and removal activities to carry out a timely, effective response.

We asked people in two regions to tell us which were the most important objectives during the emergency phase oil spill response to meet these overarching goals (and not during other phases, such as restoration, damage assessment, compensation). In most cases we heard that all of the objectives, as defined by the 42 statements in the Q sample, were important objectives. However, Q method pushes people to express relative priorities. In doing this, the participants in the research reveal that they attempt to realize the over-arching goals of spill response by emphasizing different objectives. Lack of emphasis does *not* necessarily mean that an objective was rejected. In some Q sorts, we met with individuals who expressed opposition to a stated objective (e.g., statement #4) but in most cases a low ranked statement was an expression that is was weak in relative importance.

What these results indicate is that, indeed, people that have experience with oil spills and responses in a particular region can agree about the relative importance of some objectives and disagree about the relative importance of others – even while they can all agree with higher order goals as expressed in policy and statute. Some general observations about the two cases are that:

- While protection of health and safety was important to all perspectives represented by the factors, in each case there is one that emphasizes health to a much greater extent than the others. In addition, in each case there was a perspective that suggests that protection of health and safety must be balanced with other objectives – oil spill response is dangerous work and to achieve other objectives may entail putting people in some risky situations (Buzzards Bay Factor B and San Francisco Bay Factor F);
- Mitigating ecological impacts is emphasized in each case, but not equally by all factors in each case;
- Mitigating impacts to cultural resources was not very salient in either case – perhaps because they were not so important as in the Chalk Point spill. On the other hand, mitigation of socio-cultural impacts, such as those that could occur to subsistence fishing, was ranked important in some factors;
- Mitigating economic impacts was not a high priority to any factor – but it was especially de-emphasized in Buzzards Bay. On the other hand, in two of the San Francisco Bay Factors (E and F) concern was raised about impacts to local fishermen (statements #11). While tourism and recreation are arguably important in both areas studied, impacts to local recreation was only emphasized in one factor (San Francisco Bay Factor F);
- There was no support for minimizing costs to the responsible party resulting from the response in any of the Factors; even though this was expressed as a concern because costs must be justified. Similarly, a requirement of OPA 90 is that sites affected by the spill must also be returned to their conditions prior to the spill; support for this objective (statement #9) was weak in all but two of the Factors (San Francisco Factors E and F);

- Objectives related to addressing public concerns were almost universally ranked by respondents as objectives they would be unlikely to emphasize. There were two exceptions. In Buzzards Bay Factor C it was very important to ensure that consistent and accurate information be provided to the public (32) and in San Francisco Bay Factor E it was important that Unified Command manage expectations about the clean-up so that they are reasonable (38). The relative lack of emphasis on objectives related public opinion and public satisfaction stands in contrast to the emphasis that they were given in our case study interviews (Tuler et al. 2006a) and in the literature (e.g., Lindstedt-Siva 1999);
- As overall themes (as shown in Tables 7 and 11), coordinated response and timely response were always emphasized to the same degree. However, these were not equally important in all factors; and
- In most factors the role of scientific analysis (statement #23) was emphasized when following the contingency plan (statement #24) was not – and vice versa. There was a negative relationship between the two in five of the six factors.

Moreover, in the Buzzards Bay case results are *weakly* suggestive that some perspectives may be associated with organizational affiliations (e.g., local responders vs. federal officials). This should not be over-interpreted, however, as these data are limited in what they can tell us about the relationships between organizational interests/affiliations and objectives.

There are several limitations to Q studies in general and to our studies in particular. First a limitation of Q method is that it cannot tell us:

- that these are the only perspectives that exist within the populations of interested and affected parties in the Buzzards Bay and San Francisco Bay regions (i.e., we may not have included people in the study with other points of view); and
- the frequency of these perspectives within a population. This is why the two factors that are defined by single Q sorts (individuals) in the San Francisco Bay case should not be discounted. They may be important – and the perspectives they define may be ascribed to by additional people that did not participate in our study.

Second, during the initial Q sorts we felt that respondents did not always understand our interest in the relative priority of objectives during the emergency phase of spill response. We discovered that our condition of instruction and explanations were not always adequate to ensure that we created this context for their responses. Thus, in some Q sorts it is difficult to disentangle what aspect of response individuals were thinking about. However, our notes about respondent comments during the Q sorts were helpful to some extent to make sense of this issue.

Third, we the two case studies provide only initial evidence about the adequacy of the 42 Q statements for describing the full range of objectives that interested and affected parties might believe are important for the emergency phases of oil spill response. To test the adequacy of this set, after all Q sorts we also asked individuals if there were any important objectives missing from the set of statements that they thought should have been included. In the San Francisco Bay case none were suggested. In the Buzzards Bay case three gaps in the statements were suggested: a) the importance of meeting policy and regulatory requirements, b) addressing political aspect of response, and c) getting an estimate or a number (during the response) of the amount of oil that hit the shoreline so that this could inform damage assessment later.

6. Conclusion

Additional research about the ways that interested and affected parties think about oil spill response objectives, the ways that they prioritize them, and the ways that priorities may differ can inform oil spill response planning. Some possible useful areas of future research include:

- whether there are the differences in objectives and the ways that they are prioritized depending on the phase of oil spill response that is considered (e.g., emergency response, damage assessment, recovery and restoration), including both *inter*-individual differences as well as *intra*-individual differences.
- Whether relative priorities vary depending on the context of the spill, including, for example, location, type of oil, timing, responsiveness of the responsible party, and weather. Some initial evidence that response may vary depending on the context is provided in our case study of the Chalk Point spill, in which we found that mitigation of cultural resources was important to some interviewees because of the existence of important historical and archeological sites in the area. In Buzzards Bay and San Francisco Bay no mention was made of such sites.
- whether it is important to specify more scenarios or conditions of a spill and if there be variation in relative priorities of objectives then? Many people told us that "every spill is unique" but this does not necessarily mean that goals and objectives are different.

In conclusion, this research documents that there can be differences about spill response objectives, especially when they are not defined at a general level (e.g., mitigate economic impacts). A closer look can reveal differences among people, as Abordaif et al. (1995) and Lindstedt-Siva (1999) also find. This is important because before stakeholders can fruitfully discuss performance metrics to a) guide planning for future responses or b) assess past or future spill responses there needs to be some agreement about which objectives are being measured.

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