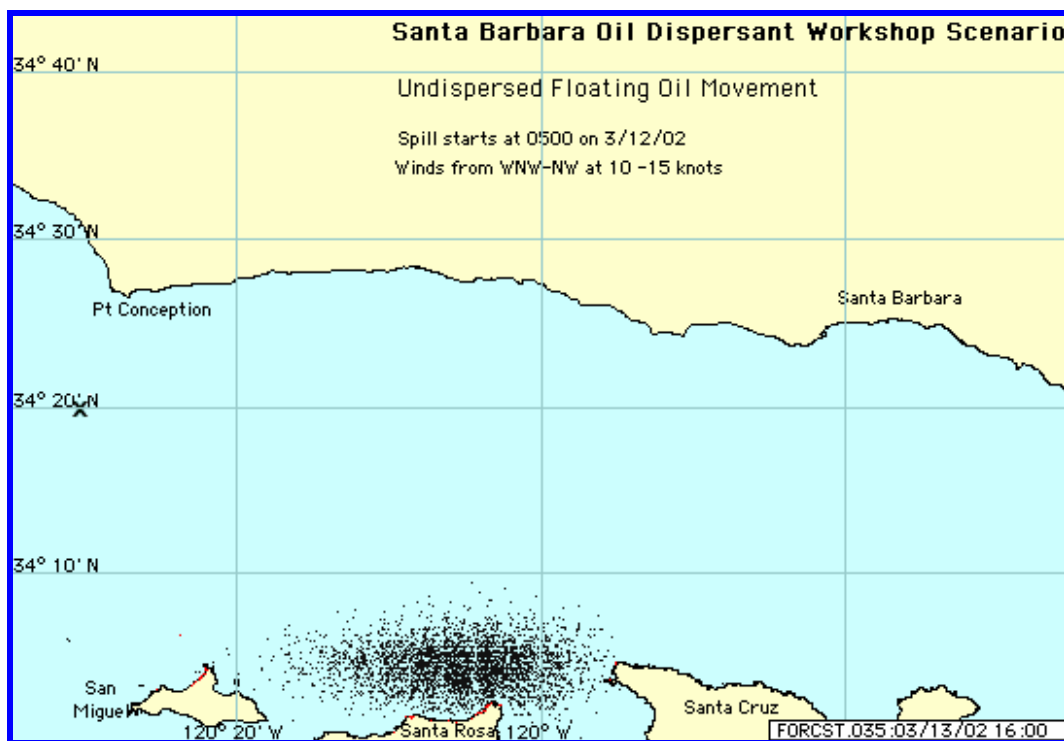

Ecological Risk Assessment: Consensus Workshop

Environmental Tradeoffs Associated With Oil Spill Response Technologies

Santa Barbara Channel



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Oil Spill Response Technologies**

Santa Barbara Channel

A Report to Regional Response Team IX

Don Aurand (Compiler)
Ecosystem Management & Assoc., Inc.



Ecosystem Management & Associates, Inc.
Report 02-01

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LIST OF ABBREVIATIONS, SYMBOLS, AND ACRONYMS

Term	Abbreviation, Symbol, or Acronym
Automated Data Inquiry for Oil Spills	ADIOS
California Department of Fish and Game, Office of Oil Spill Prevention and Response	CA DFG/OSPR
Centistokes.....	cSt
Ecological Risk Assessment	ERA
Environmental Protection Agency	EPA
Environmental Sensitivity Index.....	ESI
Intermediate Fuel Oil	IFO
Meter	m
Marine Safety Office Los Angeles/Long Beach.....	MSO LALB
National Oceanic and Atmospheric Administration	NOAA
NOAA Office of Hazardous Materials Response	NOAA HAZMAT
Parts per million.....	ppm
Regional Response Team.....	RRT
Scientific Support Coordinator	SSC
Square Kilometers.....	km ²
United States Coast Guard	USCG
USCG Office of Response	USCG (G-MOR)

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Ecological Risk Assessment: Consensus Workshop

Environmental Tradeoffs Associated With Oil Spill Response Technologies

Santa Barbara Channel

Executive Summary

In March and April of 2002, Regional Response Team (RRT) IX sponsored a workshop to evaluate the relative risk to natural resources from various oil spill response options (on-water mechanical recovery and dispersant application) in comparison to natural recovery. The spill scenario involved the release of 10,000 barrels of Intermediate Fuel Oil (IFO) 180 in the northern end of the Santa Barbara Channel, under conditions which threatened the interior coastline of the Channel Islands. The workshop involved two meetings during which participants received briefings on the expected results of the spill with and without response options, the relative effectiveness of on-water mechanical recovery, dispersants and on-water in situ burning, and the risks and benefits of these response options to the habitats and natural resources of the area. The participants were then divided into three focus groups and were asked to develop relative risk scores for the various alternatives, using standard analytical protocols outlined in the Coast Guard guidebook entitled "Developing Consensus Ecological Risk Assessments: Environmental Protection in Oil Spill Response Planning. A Guidebook." The scores from the three groups were then compared and a composite risk matrix developed which represented the overall consensus of the entire group. At the conclusion of the second meeting, the group developed a list of lessons learned and recommendations for the RRT and local Area Committee which they felt would improve local response planning efforts.

1.0 Objectives of the Santa Barbara Channel Workshop

1.1 Background and Process

Since 1998, the U.S. Coast Guard (USCG) has been sponsoring efforts to develop a comparative risk methodology to evaluate oil spill response options in a training or planning environment. Interest in selecting response options based on a risk/benefit analysis goes back even further, but the current effort is different in that it emphasizes a consensus-building approach to evaluate risks and benefits.

USCG Headquarters (G-MOR) has sponsored the development of a guidebook on this process. The document, entitled “Developing Consensus Ecological Risk Assessments: Environmental Protection in Oil Spill Response Planning. A Guidebook” is available from G-MOR, or can be downloaded from the contractor’s web site at www.ecosystem-management.net.

The process is designed to help planners compare the ecological consequences of response options, especially in nearshore or estuarine situations. This is particularly important for consideration of dispersants and in-situ burning, which present difficult analytical issues. It is focused on ecological “trade offs” or cross-resource comparisons. Through a structured analytical approach the participants find “common ground” for evaluation of impacts and develop a defensible logic to support their conclusions. This process is consistent with the U.S. Environmental Protection Agency’s (EPA) Ecological Risk Assessment (ERA) guidelines (US EPA, 1998), but emphasizes development of group consensus among stakeholders. The process uses a series of analytical tools specifically developed for use in a group environment. It is designed to be a training and planning tool, and should not be used during an actual event. The knowledge gained by participants in the process, however, will facilitate real-time decision-making.

The training usually involves two 2 or 3-day workshops lead by a facilitator. The ideal size is 25 to 30 participants, including spill response managers, natural resource managers and trustees, subject matter experts, and non-governmental organizations. The goal is to achieve consensus interpretations of the potential risks and benefits associated with selected response options based on a scenario developed by the local participants. The time between the two workshops is used for the participants to research issues of concern before they develop their final conclusions. The process is heavily focused on achieving a consensus interpretation of the available technical information. It is very important to have a broad representation of the potential stakeholders in the decision process; otherwise the results may not be accepted by all of the groups who will be concerned if a spill occurs.

The workshop process includes three primary phases - **problem formulation, analysis, and risk characterization**. Details of the process are described in the Guidebook.

In the first phase, **problem formulation**, participants in the Santa Barbara Region workshop developed a scenario for analysis, identified resources of concern along with associated assessment thresholds, and prepared a conceptual model to guide subsequent analysis.

In the **analytical phase**, participants characterized exposure and ecological effects. The conceptual model, developed in the problem formulation phase directed the analysis us-

ing standard templates and simple analytical tools that define and summarize the analysis for each resource of concern and each response option.

Finally, the participants completed a **risk characterization**. During this phase, participants interpreted their results in terms of the costs and benefits of each response option to overall environmental protection as compared to natural recovery (i.e., baseline).

1.2 Sponsor’s Objectives

This series of workshops was sponsored by Regional Response Team (RRT) IX in support of oil spill response planning by the Los Angeles/Long Beach (CA) Area Committee, Northern Sector. The overall purpose of the project was to evaluate the ecological resource impacts of spilled oil and oil spill response operations off the Southern California coast.

The results of this ERA process are intended to improve oil spill response strategies and to enhance existing oil spill contingency planning. There are tradeoffs to every response decision. Exercises such as this are intended to help identify those natural resources at risk during a spill and to address the benefits and inherent tradeoffs associated with the different spill response tools.

Resource trustee consultation is essential to identifying those tradeoff priorities that drive spill response strategy. In the spirit of promoting as much pre-spill consultation and tradeoff dialogue as possible, an ERA training session was provided prior to the evaluation of the scenario. It has been the experience of the workshop organizers in a previous workshop in Northern California that once participants are familiar with the ERA process and its methodology, resource and response agency stakeholders are better able to engage in effective risk assessment and tradeoff identification for pre-spill and spill-specific consultations. The result is a better understanding of resource trustee and response agency concerns, more timely and effective response decisions, and greater resource protection and recovery.

1.3 Participants and Responsibilities

A total of 33 individuals attended one or both of the workshop sessions. Their names and affiliations are provided in Appendix A. These 33 people represented a wide range of organizations and were divided into three focus groups for the purpose of the workshops, as indicated in the tables.

2.0 Overview of Workshop Events

This training exercise consisted of two workshops, the first held on 12-13 March 2002 and the second on 9-11 April 2002.

At the first workshop the meeting began with an overview of the ERA process followed by a discussion of the basic scenario, the habitats of concern, the analytical process, the risk ranking matrix, and the basic fate information developed for the oil if no response was initiated (the natural recovery baseline). The National Oceanic and Atmospheric Administration (NOAA) modeling results were presented by Heather Parker-Hall, the NOAA Scientific Support Coordinator (SSC) for RRT IX. After these discussions were completed, the participants were divided into three focus groups in order to begin the analysis. Day one ended with the completion of a test section of the risk matrix, in order to ensure that the participants understood the process.

On day two the participants completed the evaluation of the natural recovery baseline. The results of the three groups were compared and differences discussed and resolved to the extent possible. The risk scores associated with this option form the basis for the evaluation of the various response options at the second workshop. The participants agreed that at the next workshop they would consider (in order) on-water mechanical recovery, dispersant application, and, if sufficient time was available, on-water in situ burning.

The second workshop began with a review of the results of the first workshop, and then the anticipated consequences of an on-water mechanical recovery response were discussed by Jim Caesar of Clean Seas. He described the basic limitations involved in mechanical recovery (particularly weather and encounter rate), and then reviewed the existing capabilities to respond to a spill of the type presented by the scenario. Even though the local response organizations are well positioned to be on-scene within two to four hours, the volume of the spill and the speed at which the slick was moving towards the Channel Islands would make it unlikely that more than 20 to 25% of the spilled oil could be recovered, even under ideal circumstances. At the conclusion of his presentation, the focus groups evaluated the risk scores for on-water mechanical recovery, using the natural recovery risk scores as the basis (i.e. did mechanical recovery offer increased benefits or risks, and to what degree).

On day two the meeting opened with a review and reconciliation of the focus group scores for on-water mechanical recovery. When that was completed, Al Allen of Spiltec presented an overview of the use of dispersants and on-water in situ burning. This was followed by a presentation by Jim Clark of Exxon Mobil Research and Engineering on the toxicity of dispersants and dispersed oil and on the potential consequences of expected exposures in spill events. When these presentations were completed, the dispersed oil trajectory analysis was presented by Heather Parker-Hall and Alan Mearns of NOAA. The focus groups then convened and completed the risk evaluation for dispersant use.

On the morning of day three the dispersant risk evaluation was completed, but there was insufficient time to conduct a detailed evaluation of any other options. The afternoon of the last day was devoted to an evaluation of the results of the workshop, and the development of a list of lessons learned.

3.0 Exercise Scenario and Basic Analytical Information

3.1 Exercise Scenario

After consideration of a variety of options, the Assessment Team agreed that the scenario would be a release of 10,000 barrels of Intermediate Fuel Oil (IFO) 180 in the shipping lane southeast of Point Conception in the Santa Barbara Channel. Ship collisions which could cause this type of release represent a realistic threat for the area. The volume was selected to represent a credible release, but one that would not overwhelm the potential spill response and would allow the maximum benefits of the ERA. The exact location of the release was 34°20'N, 120°30'W. The release occurred from 0500 to 0600 on the morning of 12 March 2002. Based on a review of average winds for the area at the time of the spill winds were from the NW at 15 knots, and were maintained for the entire period.

3.2 Geographic Area of Concern

The general area of concern was the coastline of the Channel Islands and the waters of the Santa Barbara Channel. At the beginning of the workshop there was discussion by the participants as to whether or not the shoreline of the mainland should be included, since the spill trajectory did not impact that area. The decision was that the participants should focus on the Channel Islands, but for resources which were found in both areas, the mainland areas could be considered as part of the available resource, if it seemed appropriate.

3.3 Resources of Concern

The participants agreed to use the resource table from a previous San Francisco Bay workshop as a template for developing the Santa Barbara habitat list. They did not see the need to create a new list of species for each habitat, but they did modify the list to fit the local circumstances. The habitats used in this analysis, and the resource groups in each habitat, are listed in each of the preliminary risk figures for each focus group. Two habitats, “Sea Caves” and “Surf Grass/Algae” were initially included in the analysis, but after completing the natural recovery analysis the participants felt they were unnecessary. They are shaded gray in the figures. The basic information source used to identify the resources and habitats were the Area Contingency Plan Los Angeles/Long Beach, Section 4600 and the NOAA Environmental Sensitivity Indexes (ESIs) for California.

3.4 Conceptual Model

During discussions about the general analytical process, the participants decided that establishing a detailed model was not necessary for their purposes. They agreed to use the list of seven hazards developed in the San Francisco Bay workshop to evaluate each of the proposed response options (air pollution, aqueous exposure, physical trauma, oiling/smothering, thermal, waste and indirect). They agreed that the response options to be considered would

be natural recovery (no response), on-water mechanical recovery, dispersant application (high and low efficacy), and if time was available, on-water in situ burning.

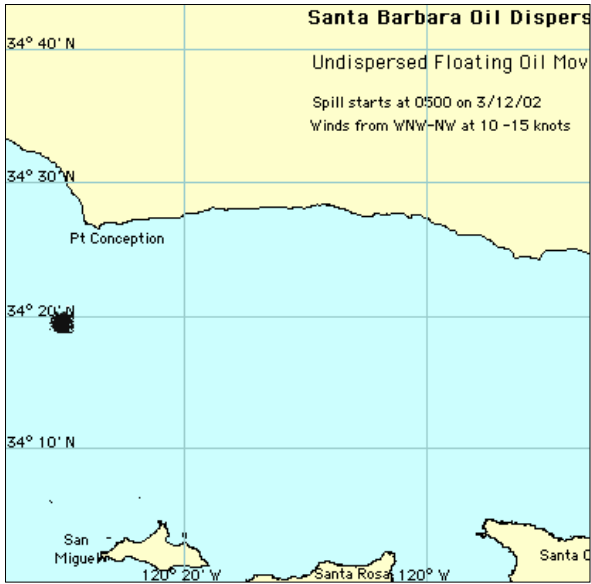
3.5 Modeling Results

The NOAA HAZMAT Modeling Group used the basic information in the scenario to develop a surface trajectory and a dispersed oil trajectory analysis for the workshop. Details of model inputs for the workshop can be obtained from the NOAA SSC. Basic weathering information was calculated using the Automated Data Inquiry for Oil Spills (ADIOS) II program. The oil weathered very slowly, with only 9% evaporated at 24 hours, 14% at 48 hours, and 20% after 5 days. Little or no natural dispersion was expected, and the oil does not tend to emulsify. Viscosity initially is approximately 2500 centistokes (cSt), and increased to more than 20,000 cSt within 24 hours.

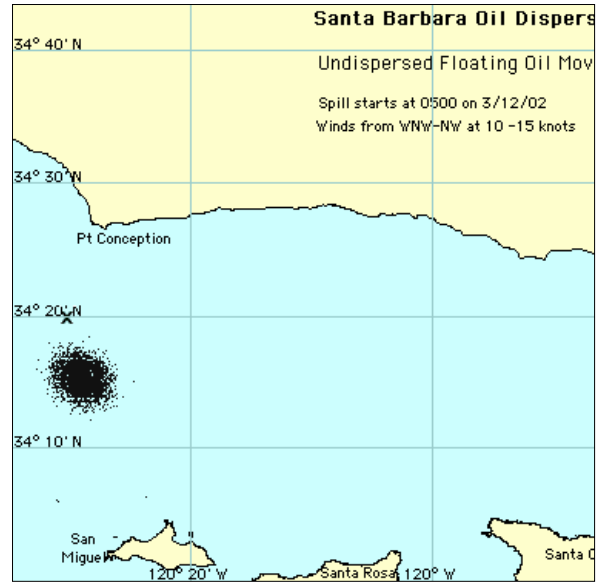
Selected snapshots from the modeling results for the surface oil trajectory are shown in Figure 3.1. Under the prevailing winds the oil moves rapidly to the south east and within 22 hours begins to contact the shoreline of San Miguel Island. After grazing San Miguel, the slick continues to the east and after approximately 30 hours begins to heavily impact Santa Rosa Island and by 36 hours oil is also coming ashore on Santa Cruz Island. Both are heavily oiled. Oil also moves through the passages between the islands, but this movement lies outside of the model grid. Extensive shoreline contamination would be expected on the islands, much of it in very rugged and sensitive areas of high ecological concern.

Snapshots from the dispersed oil modeling results are shown in Figures 3.2 to 3.4 for 20%, 35% and 80% overall effectiveness, respectively. While the results are presented for all three efficiencies, the workshop participants focused on the results for 80% effectiveness because the lower effectiveness results did not offer sufficient shoreline protection. The concentrations of dispersed oil in the water column, and the areas affected by different concentrations through time are shown in Tables 3-1 and 3-2. The colored contours of dispersed oil concentration in the figures are the averaged concentration of dispersed oil from 0 to 3 meters (m) depth. These are conservative estimates in that in real events dispersed oil distribution is more patchy. For the 80% effectiveness scenario, the highest average concentration of dispersed oil, 25 parts per million (ppm), was predicted to be limited to the surface three m. If the mixing depth were greater, then this concentration would be less. The largest area affected was 13 km², and by 24 hours after dispersant application this area was less than one km². By 48 hours the maximum average concentration was less than 10 ppm.

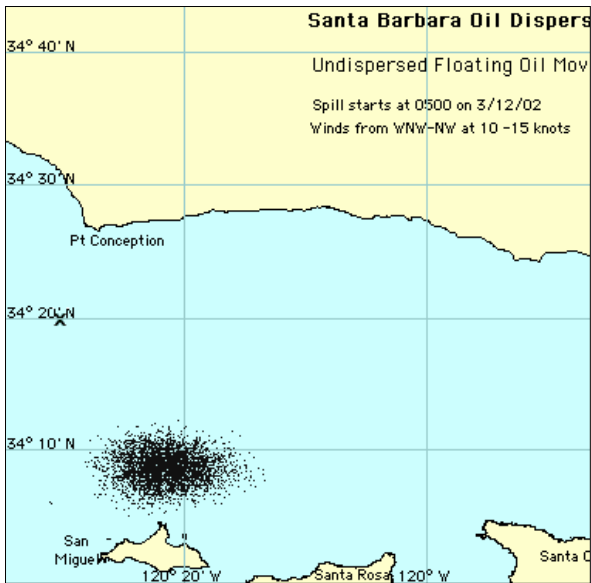
Areas and durations for lower concentration levels were also examined when estimating potential impacts to water column organisms. Based on a threshold of 1 ppm for the most sensitive organisms (planktonic early life history stages of fish and invertebrates), the maximum affected area would have been about 76 km², for a period of approximately 24 to 72 hours. Based on a threshold value of 10 ppm (for other planktonic organisms), the area of concern would be limited to the surface layer, would not exceed 13 km² and would last 24 hours or less.



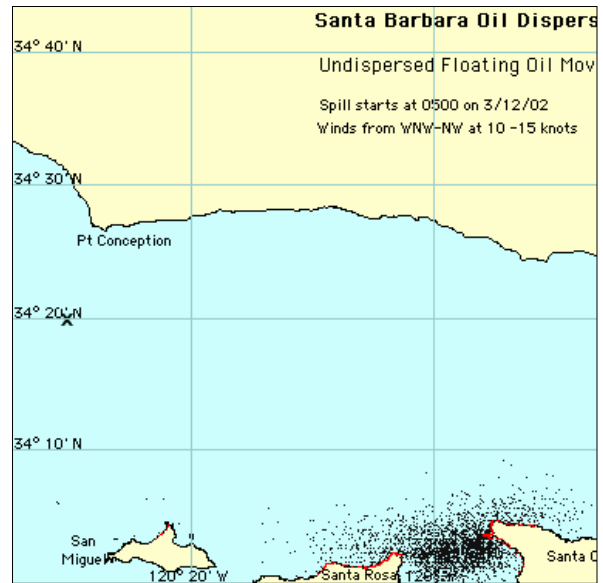
A: 1 Hour (End of Release)



B: 7 Hours

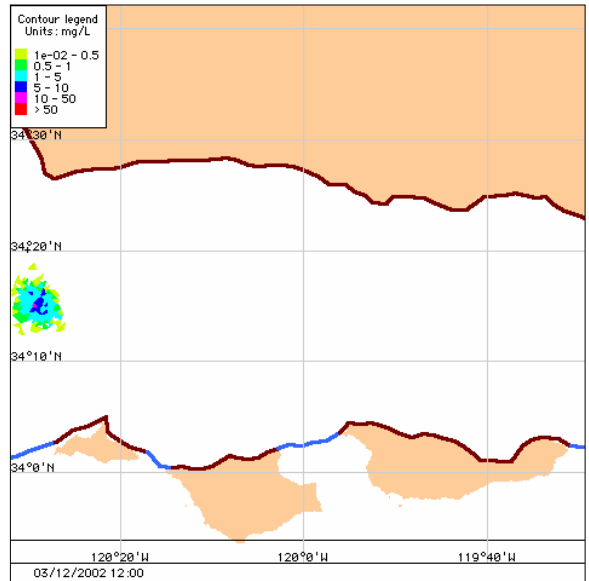
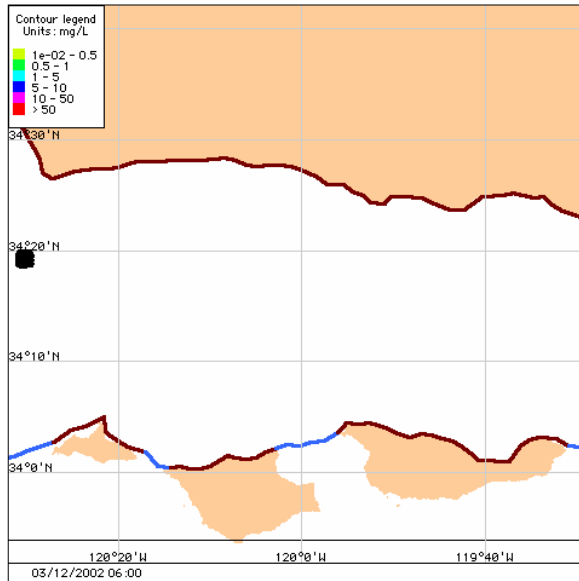


C: 19 Hours



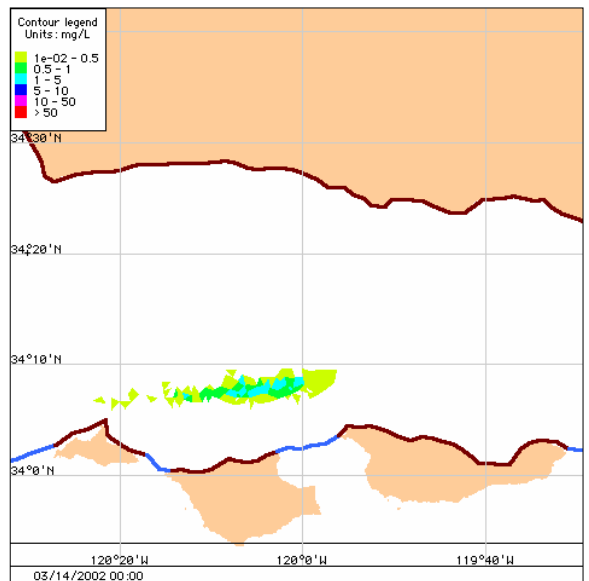
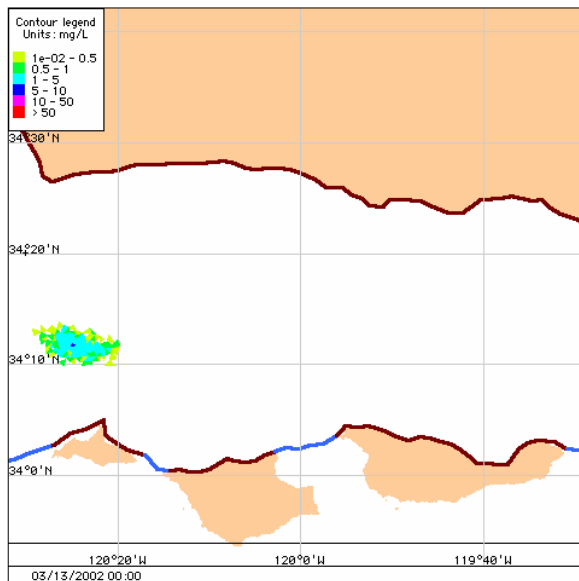
D: 43 Hours

Figure 3.1 Results from the NOAA scenario modeling for the surface oil slick trajectory.



A: 1 Hour (End of Release)

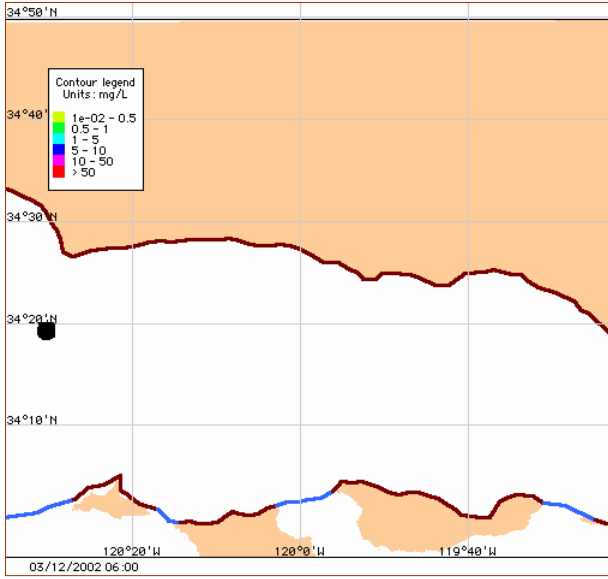
B: 7 Hours (Initial Dispersion)



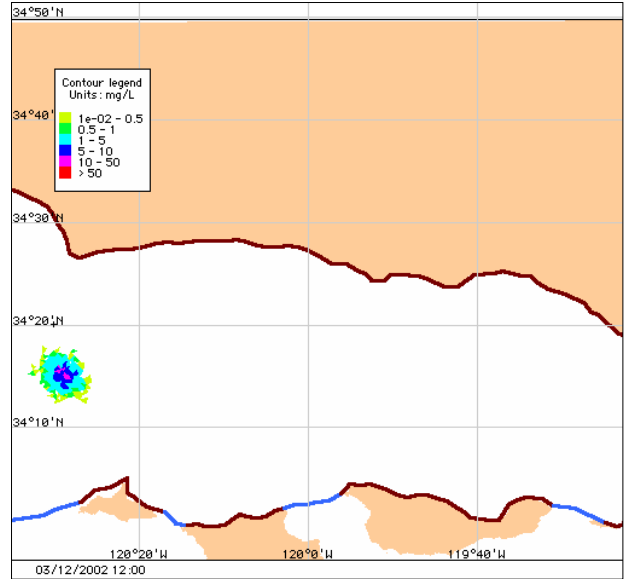
C: 19 Hours

D: 43 Hours

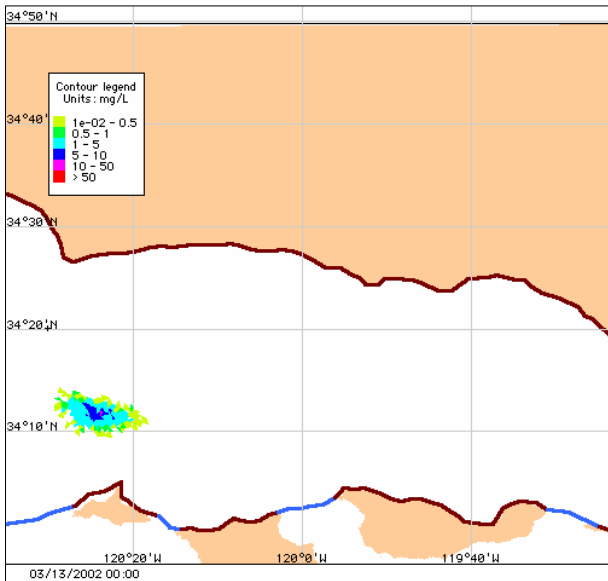
Figure 3.2 Results from the NOAA scenario modeling for dispersant use at 20% efficiency. (Surface oil remaining after application not shown)



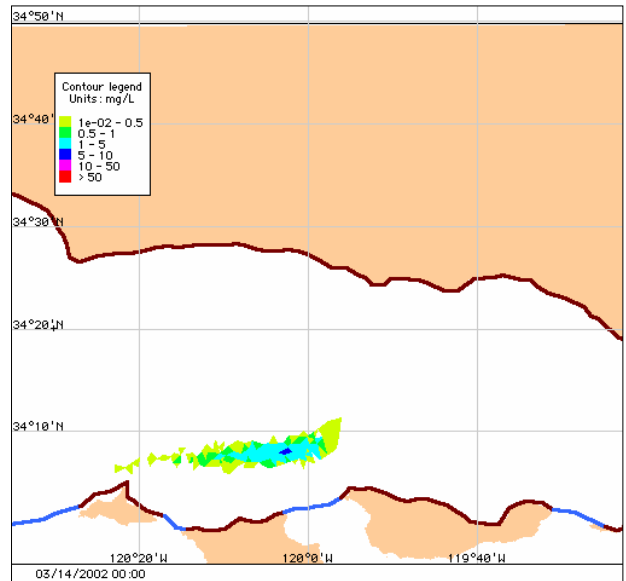
A: 1 Hour (End of Release)



B: 7 Hours (Initial Dispersion)

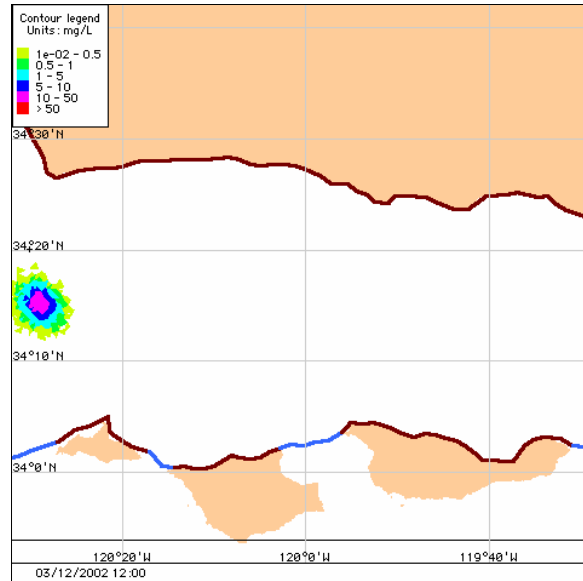
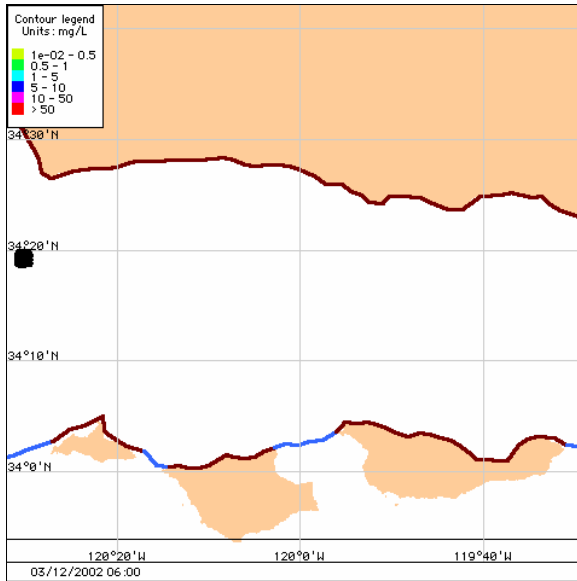


C: 19 Hours



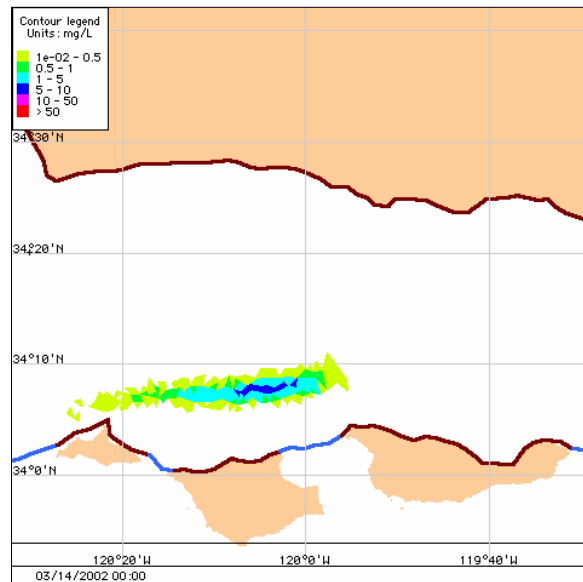
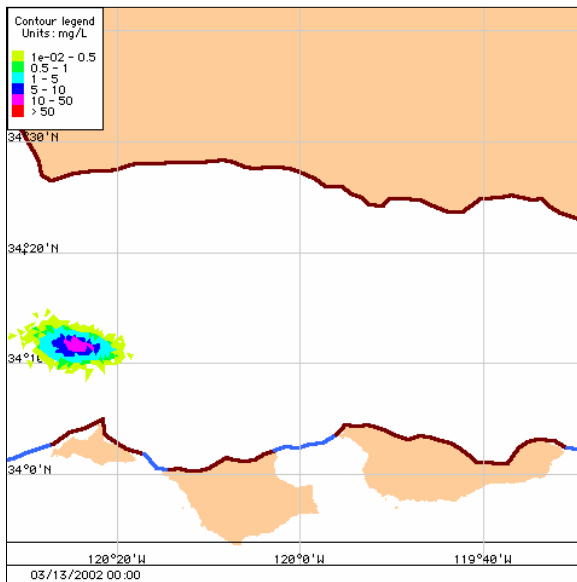
D: 43 Hours

Figure 3.3 Results from the NOAA scenario modeling for dispersant use at 35% efficiency. (Surface oil remaining after application not shown)



A: 1 Hour (End of Release)

B: 7 Hours (Initial Dispersion)



C: 19 Hours

D: 43 Hours

Figure 3.4 Results from the NOAA scenario modeling for dispersant use at 80% efficiency. (Surface oil remaining after application not shown)

Table 3.1 Estimates of the Concentration of Dispersed Oil in the Water Column at Various Depths Over Time

Hours Since Dispersion	Estimated Average Maximum Concentration of Dispersed Oil at Various Water Depths (ppm)								
	0-3m			3-6m			6-10m		
	20%	35%	80%	20%	35%	80%	20%	35%	80%
3	7.5	25	25	2.5	7.5	0.75	0	0	0
6	7.5	7.5	25	2.5	2.5	2.5	0.25	0.25	0.25
12	2.5	7.5	25	2.5	2.5	2.5	0.25	0.25	0.25
24	2.5	7.5	25	0.75	2.5	2.5	0.25	0.25	0.75
48	0.75	2.5	7.5	0.75	0.75	2.5	0.25	0.25	0.75
72	0.75	2.5	7.5	0.75	0.75	2.5	0.25	0.25	0.75

Table 3.2 Estimates of the Area Affected by Various Concentrations of Dispersed Oil in the Water Column Over Time

Hours Since Dispersion	Estimated Area (Km2) at 0 to 3 Meters Depth at Various Dispersant Efficiencies														
	0.5 - 1 ppm			1 - 5 ppm			5 - 10 ppm			10 - 50 ppm			>50 ppm		
	20%	35%	80%	20%	35%	80%	20%	35%	80%	20%	35%	80%	20%	35%	80%
3	11	10	9	25	27	25	2	10	12	0	1	13	0	0	0
12	12	12	10	24	30	33	0	6	12	0	0	8	0	0	0
24	14	15	11	22	37	47	0	2	11	0	0	1	0	0	0
48	27	27	25	10	10	54	0	0	8	0	0	0	0	0	0
72	22	39	36	9	28	76	0	0	0	0	0	0	0	0	0

4.0 The Results of the Risk Analysis Process

The risk analysis matrix used by the focus groups is presented in Figure 4.1. Each focus group was tasked with reviewing the scenario, the modeling results, information on exposure and sensitivity to oil and dispersed oil, and basic life history and distribution information to estimate the percent of each resource affected and the time of recovery. In the initial evaluation the groups used the various alphanumeric codes to rate the level of concern. At the end of the workshop the various color codes were used to develop summary levels of concern.

		RECOVERY			
		> 10 years (SLOW) (1)	5 to 10 years (2)	1 to 4 years (3)	< 1 year (RAPID) (4)
% of RESOURCE AF- FECTED	> 50% (LARGE) (A)	1A	2A	3A	4A
	30 to 50% (B)	1B	2B	3B	4B
	10 to 30% (C)	1C	2C	3C	4C
	0 to 10% (SMALL) (D)	1D	2D	3D	4D

Legend: Red cells represent a “high” level of concern, yellow cells represent a “moderate” level of concern, and green cells represent a “limited” level of concern.

Figure 4.1 Definition of levels of concern for the Santa Barbara region.

The detailed focus group results for natural recovery are shown in Figure 4.2. The results for the various habitats among the three groups are relatively consistent, with high levels of concern for birds and mammals on the sea surface and for sandy beach and rocky intertidal habitats. The only area of noticeable disagreement was in the ranking of sea caves. This is a fairly unique habitat to the Channel Islands, and represents specialized nesting habitat for certain marine birds. Such areas would be extremely vulnerable and difficult to protect.

The risk results for on-water mechanical recovery are shown in Figure 4.3. All of the focus groups determined that it was unlikely to result in significant benefits to the three habitats listed above, and might pose an increased risk to very shallow, nearshore soft bottom areas. The primary concern was the limited time available to implement mechanical recovery options, and the anticipated low effectiveness, based on the encounter rate. The local response organizations are very likely to be on-site within a few hours, but are still unlikely to recover more than about 25% of the oil (workshop estimate) and possibly much less. There isn’t going to be much time to implement shoreline protection strategies, either, and in many areas they might not be effective because of local oceanographic and shoreline conditions. One group emphasized that they felt that mechanical recovery could benefit the environment, and could be particularly important for specific areas, but the analysis was not precise enough to identify such benefits. All groups felt that any oil that could be recovered would

ultimately be a benefit. All groups decided that it was unnecessary to maintain sea caves and surfgrass/algae as separate subhabitat groups because the concerns for these areas could adequately be covered under other categories.

Risk results for dispersant use at an overall effectiveness of 80% are presented in Figure 4.4. The groups were in agreement that in this scenario the use of dispersants did not pose an increased risk to water column communities, even those near the water surface, based on the estimated exposures and on the sensitivities of the organisms of concern. While there was a consensus that individual organisms within the dispersed oil plume could be adversely affected, and that sensitive life history stages might suffer some mortality, at the population level these effects were not judged to be important. The expected benefits to shoreline and surface water habitats varied between the three groups. All groups also saw the potential for dispersant use to offer some level of protection for the water surface, coastal salt marsh and mudflats, two groups expected lower risk for sandy beach, and one group expected to see less risk to rocky intertidal habitat. In general, the reduction in risk was not large and did not change the overall risk category, because participants felt that sufficient oil still reached these habitats to cause concern.

At the end of the meeting the groups discussed dispersant application in cases of lower effectiveness. The conclusion was that unless the application was fairly efficient there was little benefit. However, there was also little risk and so it was worth attempting. Some participants also pointed out that, in this scenario, there was only one attempt at dispersant application, whereas in a real spill additional applications could be made and targeted against areas of the slick posing a threat to specific resources.

One other general result of the discussions was that the conclusions were often driven by individual species or specific areas of concern. A notable case in point was the black abalone, and to a lesser extent the Pismo clam. The black abalone is so rare that even its distribution is unclear, as is its sensitivity to oil, either floating or dispersed. Most of the workshop participants were unaware that it was even an issue, which served to reinforce the value of this type of planning exercise.

Zones		Terrestrial						Water Surface	Intertidal																											
Habitats		Upland & Supratidal							Coastal Salt Marsh and Mudflats						Sandy Beach				Sea Walls/Pilings/RipRap				Rocky Intertidal													
Sub-Habitats																																				
Resources		Vegetation	Mammals	Birds	Reptiles/Amphibians	Insects	Mammals	Birds	Reptiles/Amphibians	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Polychaetes	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna							
Group		NA	D3	D3	NA	E4	B2	A2	E3	B2	NA	E3	NA	C4	D4	D4	B3	A1	D4	C4	C4	E1	NA	NA	NA	NA	NA	NA	C3	D4	B3	C3	E4	C4	A1	C2
Natural Recovery		E4	E4	D3	NA	NA	C3	B1	E2	C3	E4	E3	E4	E3	E3	C3	B1	E4	E4	E4	D3	NA	E4	E4	E4	E4	E4	C3	D4	D3	E3	E3	A1	E3	E3	E3
		NA	E4	D3	NA	NA	C3	B1	E2	C3	E4	E3	E4	E3	E3	C3	B1	E4	E4	E4	D3	NA	E4	E4	E4	E4	E4	C3	D4	D3	E3	E3	A1	E3	E3	E3
		NA	E4	D3	NA	NA	C3	B1	E2	C3	E4	E3	E4	E3	E3	C3	B1	E4	E4	E4	D3	NA	E4	E4	E4	E4	E4	C3	D4	D3	E3	E3	A1	E3	E3	E3
		NA	E4	D3	NA	NA	C3	B1	E2	C3	E4	E3	E4	E3	E3	C3	B1	E4	E4	E4	D3	NA	E4	E4	E4	E4	E4	C3	D4	D3	E3	E3	A1	E3	E3	E3

Zones		Intertidal (Continued)												Subtidal																						
Habitats		Sea Caves						Cobble Beach						Shallow Softbottom (<35 feet)						Benthic Bays and Inlets																
Sub-Habitats																																				
Resources		Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	
Group		E3 <th colspan="1">E4 <th colspan="1">NA <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 </th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th></th>	E4 <th colspan="1">NA <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th colspan="1">E4 <th 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Natural Recovery		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	
		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	
		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4

Zones		Subtidal (Continued)																																	
Habitats		Shallow Softbottom (<35 feet)						Deep Softbottom (>35 feet)						Shallow Hardbottom (<35 feet)						Deep Hardbottom (>35 feet)						Kelp Forest									
Sub-Habitats																																			
Resources		Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna
Group		NA	NA	E4	E4	E4	E4	E4	NA	NA	NA	NA	NA	NA	E4	NA	NA	NA	E4	E1	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	
Natural Recovery		E4	NA	E3	E4	E3*	E3	NA	NA	E4	E4	E4	E4	E4	E4	NA	NA	NA	E4	NA	E4	E3	E4	E3*	E3	E4	E4	E4	E4	E4	E4	E4	E4	E4	
		E4	NA	E3	E4	E3*	E3	NA	NA	E4	E4	E4	E4	E4	E4	NA	NA	NA	E4	NA	E4	E3	E4	E3*	E3	E4	E4	E4	E4	E4	E4	E4	E4	E4	
		E4	E3	E4	E4	E4	E4	NA	NA	NA	NA	NA	NA	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	
		E4	E3	E4	E4	E4	E4	NA	NA	NA	NA	NA	NA	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4

Zones		Subtidal (continued)												Water Column																					
Habitats		Surfgrass/Algae						Coastal (Open Water)						Bays and Inlets																					
Sub-Habitats								Shallow Water (<35 feet)						Deep Water (>35 feet)																					
Resources		Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epiifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks		
Group		NA*	NA*	E4	E4	E4	E4	E4	NA*	NA*	E4	E4	E4	E4	NA*	NA*	E4	E4	E4	E4	NA*	NA*	E4	E4	E4	E4	NA*	NA*	E4	E4	E4	E4			
Natural Recovery		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4			
		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4		
		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	
		E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4

Figure 4.2 Detailed focus group risk analysis results for natural recovery.

Zones	Terrestrial		Water Surface		Intertidal																													
Habitats	Upland & Supratidal				Coastal Salt Marsh and Mudflats				Sandy Beach				Sea Walls/Pilings/RipRap				Rocky Intertidal																	
Sub-Habitats																																		
Resources	Vegetation	Mammals	Birds	Reptiles/Amphibians	Insects	Mammals	Birds	Reptiles/Amphibians	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Polychaetes	Mammals	Birds	Fish	Crustaceans	Meiofauna	Mollusks	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna
	Group																																	
1	E4	E3	E3	E4	E4	D2	B2	NA	D3	NA	E3	NA	D3	NA	E4	E4	E4	E4	E4	E4	E4	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
2	E4	E4	E3	NA	NA	D3	C2	E3	E3	E4	E4	E4	E4	E4	E4	D3	C2	E4	E4	E4	D1	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
3	NA	E4	D3	NA	NA	A2	D2	E2	B3	E4	E3	E4	E4	E4	E4	B2	B3	E4	E4	E4	B1	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4

Zones	Intertidal (Continued)												Subtidal																					
Habitats	Sea Caves						Cobble Beach						Shallow Softbottom (<35 feet)						Benthic Bays and Inlets															
Sub-Habitats																																		
Resources	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna	Mammals	Birds	Fish	Crustaceans	Meiofauna	Mollusks	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Polychaetes	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna	Fish	Crustaceans	Mollusks	Polychaetes	Vegetation		
	Group																																	
1								E3	E4	NA	E4	E4	E4	E4	NA	NA	E4	E4	E4	E4	E4	NA	NA	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	
2								E4	E4	E4	E4	E4	E4	E4	E4	NA	E4	E4	E4	D4	E3	E4	E4	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4
3								E4	E3	NA	E4	E4	E4	E4	E4	E3	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4

Zones	Subtidal (Continued)																															
Habitats	Benthic Coastal												Kelp Forest																			
Sub-Habitats	Shallow Softbottom (<35 feet)						Deep Softbottom (>35 feet)						Shallow Hardbottom (<35 feet)						Deep Hardbottom (>35 feet)													
Resources	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna					
	Group																															
1	NA	NA	E4	E4	E4	E4	E4	NA	NA	E4	E4	E4	E4	E4	NA	NA	E4	E4	E4	E4	E4	NA	NA	NA	E4	E4	E4	E4	E4	E4	E4	E4
2	E4	E4	E3	E4	E1	E4	E4	E4	NA	E4	E4	D4	E4	NA	NA	E4	E4	E4	E4	E4	E4	E4	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4
3	E4	E3	E4	E4	E1	E4	E4	NA	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4	E4

Zones	Subtidal (continued)												Water Column												
Habitats	Surfgrass/Algae						Coastal (Open Water)																		
Sub-Habitats							Shallow Water (<35 feet)						Deep Water (>35 feet)												
Resources	Vegetation	Mammals	Birds	Fish	Crustaceans	Mollusks	Epifauna	Mammals	Birds	Fish	Crustaceans	Mollusks	Plankton	Reptiles	Mammals	Birds	Fish	Crustaceans	Mollusks	Plankton	Mammals	Birds	Fish	Crustaceans	Mollusks
	Group																								
1								NA	NA	E4	E4	E4	E4	E3	NA	NA	E4	E4	E4	E4	E4	NA	NA	E4	E4
2								D4	D4	E3	NA	E4	E4	E4	E4	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4
3								E4	E4	E4	E4	E4	E4	E3	NA	NA	E4	E4	E4	E4	E4	E4	E4	E4	E4

Figure 4.4 Detailed focus group risk analysis results for dispersant application at 80% effectiveness.

scores reported in the matrix, nor were potential areas that may have been affected beyond four days (such as the mainland). Differences between response options might have been more pronounced if we had considered a longer period of time.

- At the beginning of the meeting, we identified expectations. The major objective was comparison of response methods and effects resulting from those. There is also an expectation that the results of the workshop could benefit Area Planning. The relative benefits of a scenario vs. a "what if" analysis is dependant upon the ultimate use of the information.
- For dispersants, the group focused only on the use of one application on the first day. The option of additional treatments or of the tactical use of dispersants to protect specific resources was not examined. It was clear that it would be valuable to consider tactical use of all of the response technologies.
- Some of the habitat scores were driven by small numbers of threatened or highly sensitive species, i.e., snowy plover, black abalone or Pismo clams, in that habitat. In the absence of those driver conditions, overall scores for the habitats would likely have been different.
- Animals that are found in multiple habitats (as defined in the assessment) were difficult to assess. You must be careful to avoid double counting of impacts. Impacts should be evaluated where the effect occurs.
- In this scenario, dispersant or dispersed oil toxicity within the water column was evaluated and found to be a minor concern relative to other response options because of the potential for dilution because it was dispersed in the open water. We did not examine the effects of dispersant application in other areas, such as shallow water or near-shore.
- There were benefits from both on-water mechanical recovery and from dispersant application, when a high level of effectiveness was assumed. Both response options were well within state and federal response guidelines. Neither response option prevented serious shoreline impacts because of the initial size of the spill and the limited timeframe.
- It helps to have a broad mix of local experts as well as outside subject matter experts. We need to make sure that all participants identify their expertise (place a summary where all participants can see it) and are available to the entire group when specific questions arise. (Note – this is an important issue and most information was obtained verbally, on site, and from the Area Plan and the ESI atlas. A process needs to be developed to ensure that appropriate expertise is available.)
- Given the realities of large on-water spills, and to maximize the net benefits of various response options, the decision-maker really needs to have all of the appropriate options available for use. Efforts should continue in preplanning for streamlining the use of response options.
- This workshop did not address what the restrictions to dispersant use should ultimately be beyond the existing zones. It focused on a specific scenario, and on the trade-offs associated with that scenario.

Appendix A: Participants

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