# Appendix for Chapter 5

## Table of Contents

# Appendix for Chapter 5

## APPENDIX 5.1

The table below gives oil-spill risk for each unit under consideration for delineation drilling including the total risk for all the proposed-to-be-drilled units. Also, the total oil-spill risk for the other undeveloped units (Cavern Point, Rocky Point, and Sword) is given. Lastly, the oil-spill risk for all the currently-developed leases and a total for the currently-developed state leases is given. Details on how the risks are calculated are given in section 5.1.3.

***Table 5.1-1. Oil Spill Risk by Unit or Field***

| Source | Estimated Recoverable Reserves[1] ($10^6$ bbl) | Estimated Mean No. Spills | Probability of One or More Spills |
|---|---|---|---|
| Point Sal Unit (Lion Rock) | 233 (Base Case) | 50 – 999 bbls = 1.8<br>>1000 bbls = 0.32 | 50 – 999 bbls = 83.5%<br>>1000 bbls = 27.4% |
| | 305 (High Case) | 50 – 999 bbls = 2.36<br>>1000 bbls = 0.42 | 50 – 999 bbls = 90.6 %<br>>1000 bbls = 34.3 % |
| Purisima Point Unit (Santa Maria) | 90 (Base Case) | 50 – 999 bbls = 0.69<br>>1000 bbls = 0.12 | 50 – 999 bbls = 49.8%<br>>1000 bbls = 11.3% |
| | 120 (High Case) | 50 – 999 bbls = 0.93<br>>1000 bbls = 0.17 | 50 – 999 bbls = 60.6%<br>>1000 bbls = 15.7% |
| Bonito Unit | 68 | 50 – 999 bbls = 0.52<br>>1000 bbls = 0.09 | 50 – 999 bbls = 40.5%<br>>1000 bbls = 8.6% |
| Gato Canyon Unit | 77 | 50 – 999 bbls = 0.59<br>>1000 bbls = 0.10 | 50 – 999 bbls = 44.5%<br>>1000 bbls = 9.5% |
| All Proposed MODU Units | 468 (Base Case) | 50 – 999 bbls = 3.62<br>>1000 bbls = 0.62 | 50 – 999 bbls = 97.3%<br>>1000 bbls = 46.2% |
| | 570 (High Case) | 50 – 999 bbls = 4.42<br>>1000 bbls = 0.79 | 50 – 999 bbls = 98.8%<br>>1000 bbls = 54.6% |
| Rocky Point Unit | 39 | 50 – 999 bbls = 0.26<br>> 1000 bbls = 0.04 | 50 – 999 bbls = 22.9%<br>> 1000 bbls = 4% |
| Cavern Point Unit | 22 | 50 – 999 bbls = 0.23<br>> 1000 bbls = 0.04 | 50 – 999 bbls = 20.5%<br>> 1000 bbls = 4% |
| Sword Unit | 29 | 50 – 999 bbls = 0.23<br>> 1000 bbls = 0.04 | 50 – 999 bbls = 20.5%<br>> 1000 bbls = 4% |
| Total Other Undeveloped Leases and Units | 90 | 50 – 999 bbls = 0.72<br>>1000 bbls = 0.13 | 50 – 999 bbls = 51.3%<br>>1000 bbls = 12.2% |
| Santa Clara Field | 14.1 | 50 – 999 bbls = 0.11<br>> 1000 bbls = 0.019 | 50 – 999 bbls = 10.5%<br>> 1000 bbls = 1.8% |
| Sockeye Field | 46.82 | 50 – 999 bbls = 0.36<br>> 1000 bbls = 0.06 | 50 – 999 bbls = 30.3%<br>> 1000 bbls = 5.9% |
| Hueneme Field | 0.66 | 50 – 999 bbls = 0.0051<br>> 1000 bbls = 0.0009 | 50 – 999 bbls = 0.5%<br>> 1000 bbls = 0.09% |
| Pt. Arguello Field | 92.7 | 50 – 999 bbls = 0.72<br>> 1000 bbls = 0.13 | 50 – 999 bbls = 51.4%<br>> 1000 bbls = 12.2% |
| Pitas Point Field | 0.07 | 50 – 999 bbls = 0.00056<br>> 1000 bbls = 0.00009 | 50 – 999 bbls = 0.056%<br>> 1000 bbls = 0.009% |
| Dos Cuadras Field | 12.7 | 50 – 999 bbls = 0.098<br>> 1000 bbls = 0.017 | 50 – 999 bbls = 11.4%<br>> 1000 bbls = 1.7% |
| Carpinteria Field | 3.27 | 50 – 999 bbls = 0.025<br>> 1000 bbls = 0.0045 | 50 – 999 bbls = 2.5%<br>> 1000 bbls = 0.45% |
| Pescado Field | 42.7 | 50 – 999 bbls = 0.33<br>> 1000 bbls = 0.058 | 50 – 999 bbls = 28.1%<br>> 1000 bbls = 5.7% |
| Hondo Field | 78.2 | 50 – 999 bbls = 0.61<br>> 1000 bbls = 0.11 | 50 – 999 bbls = 46.7%<br>> 1000 bbls = 10.4% |
| Sacate Field | 71.3 | 50 – 999 bbls = 0.55<br>> 1000 bbls = 0.098 | 50 – 999 bbls = 43.4%<br>> 1000 bbls = 9.4% |
| Point Pedernales Field | 19.1 | 50 – 999 bbls = 0.15<br>> 1000 bbls = 0.026 | 50 – 999 bbls = 14%<br>> 1000 bbls = 2.6% |
| Total Federal Ongoing Production | 381.6 | 50 – 999 bbls = 2.96<br>> 1000 bbls = 0.53 | 50 – 999 bbls = 94.9%<br>> 1000 bbls = 41.2% |
| State Reserves | 263 | 50 – 999 bbls = 2.04<br>>1000 bbls = 0.36 | 50 – 999 bbls = 87 %<br>>1000 bbls = 30.2% |

[1] Estimated Resource

## APPENDIX 5.2 CONDITIONAL OIL SPILL RISK ANALYSIS

The probabilities presented in this analysis are in the conditional context that assumes an oil spill has occurred for the cumulative impact analysis. As stated above, no oil spills are assumed for the proposed delineation wells. However, for the cumulative analysis, we assume a 200 bbl oil spill to be the most likely case, and a 2000 bbl spill to be the maximum most probable discharge (see section above). We then address the issue of resources impacted if either of these scenarios do occur. To do this we look at two oil spill models and a surface current data set assuming a spill did occur. The three analyses described below provide estimates of oil spill trajectory and potential landfall. They include MMS's Oil Spill Risk Assessment (OSRA) Model calculation, an analysis of 306 free-floating surface drifter trajectories deployed by the Scripps Institution of Oceanography (Scripps), and the National Oceanic and Atmospheric Administration's (NOAA) "General NOAA Oil Modeling Environment" (GNOME) oil spill model. These three analyses indicate a similar area of possible oil contact to the south. When the winds are relaxed for an extended period of time, the drifter data shows that oil can be transported north along the coast. Use of these three analyses is a conservative approach to identifying the possible area of oil contact for the Pacific Region. The summary of results of this composite analysis is presented in this section.

The MMS OSRA Model analysis calculates numerous trajectories from pre-designated launch points by combining observed wind data with seasonally-averaged ocean current fields and applying a local wind effect to estimate the movement of oil over the surface layer of the water. The seasonally averaged current fields were provided by Scripps Institution of Oceanography (Scripps) and are based on several years of current meter and free-floating drifter data. Shoreline segments are partitioned into their USGS Quad maps, and probabilities of oil spill landfall for each shoreline segment are calculated. Offshore boxes giving probabilities of oil spill intrusion into their defined region are presented as part of a more comprehensive regional OSRA Model analysis contained in OCS Report MMS2000-057. Oil spill size or weathering (evaporated or dispersed) are not modeled in the OSRA analysis to allow for a maximum estimate of spill travel times and extent. Results for OSRA Model runs for the nine launch points listed in appendix table 5.2-1 are included as part of the composite analysis presented in appendix subsection 5.2.1 Oil Spill Trajectory Analyses.

The free-floating surface drifters were designed to follow the surface current (top 1 meter of the water column) and not to track or mimic an oil spill. However, the drifter analysis provides good information on surface currents, which are one of the major component determining spill movement, by describing statistics on actual trajectories of free-floating surface drifters. When the winds are relaxed, or in areas where local winds do not dominate, drifter trajectories could mimic the movement of an oil spill. For example, the drifter trajectories indicate that when the winds are relaxed, oil could be transported north along the coast. A description of the surface drifters and their deployment strategy is found along with a more detailed presentation of comprehensive drifter analysis in appendix subsection 5.2.3 Surface Drifter and GNOME Model Data and Analysis. The drifter analyses consists of analyses done specifically for the Lion Rock and San Ynez Units, and drifter analyses previously written for the Rocky Point and Cavern Point projects that apply well to the Point Arguello and Santa Clara Units, and Platform Hillhouse located in the northeastern Santa Barbara Channel. These latter drifter analyses are entitled: "Surface Drifter Analysis for the Rocky Point Unit Project Oil Spill Risk Assessment" and "Surface

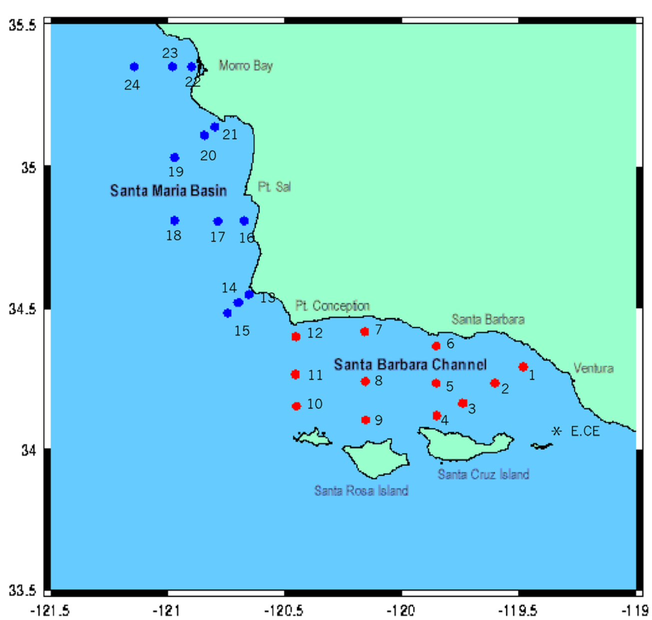
***Appendix Table 5.2-1. Launch point locations for GNOME and OSRA analyses.***

| Lease | Launch Pt. | Unit | Latitude N | Longitude W |
|---|---|---|---|---|
| 0409 | SMB A | Lion Rock Unit | 34 56' 07.80" | 120 49' 55.60" |
| 0315 | Harvest | Point Arguello Unit | 34 28 08.89 | 120 40 50.94 |
| 0316 | Hermosa | Point Arguello Unit | 34 27 19.83 | 120 38 47.00 |
| 0450 | Hidalgo | Point Arguello Unit | 34 29 42.05 | 120 42 08.24 |
| 0188 | Hondo | Santa Ynez Unit | 34 23 26.63 | 120 07 13.91 |
| 0190 | Harmony | Santa Ynez Unit | 34 22 36.03 | 120 10 03.09 |
| 0182 | Heritage | Santa Ynez Unit | 34 21 01.41 | 120 16 45.06 |
| 0205 | Gail | Santa Clara Unit | 34 07 30.29 | 119 24 00.78 |
| 0240 | Hillhouse | Northeastern Channel | 34 19 52.84 | 119 36 11.69 |

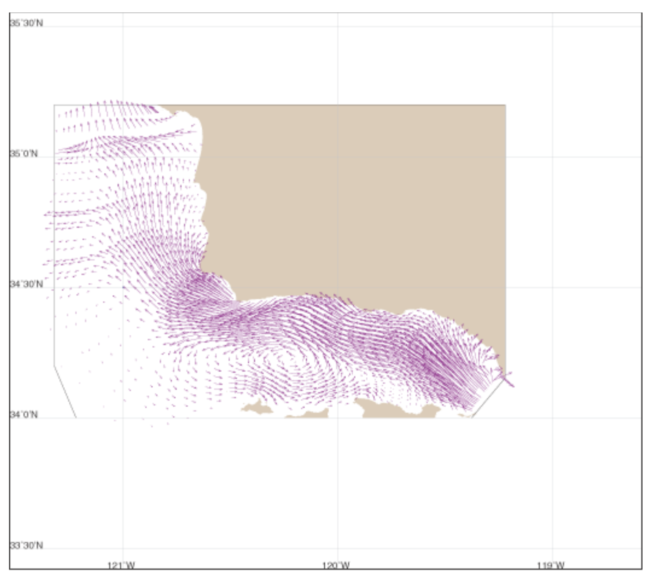
Drifter Analysis for the Cavern Point Unit Project Oil Spill Risk Assessment." The drifter analyses completed for the Lion Rock and San Ynez Units were done for each of the three flow regimes characteristic of the Santa Barbara Channel-Santa Maria Basin (SBC-SMB) area. The free-floating drifter launch points are illustrated in appendix figure 5.2-1. Examples of drifter plots for each of these three flow regimes can be found in figures 4.4-12a and b, 4.4-13a and b, and 4.4-14a and b and in appendix figures 5.2-23a and b, 5.2-24a and b, and 5.2-25a and b. The drifter analyses previously written for the Rocky Point and Cavern Point projects were done according to seasonal months coinciding with those of the MMS OSRA Model analysis performed for those same projects.

The GNOME analysis was run according to the environmental forcing and criteria for winds and currents described in Section 4.4 Physical Oceanography, subsections 4.4.4.4 to 4.4.4.7. Calculations were performed for 200 and 2000 bbl spills at each of the nine launch points listed in appendix table 5.2-1. Over 180 GNOME model runs were conducted. As is the case for part of the drifter analysis, GNOME model results were generated for the three major flow regimes described in Section 4.4: Relaxation, Convergent, and Upwelling. Scripps provided synoptic current fields for the GNOME model that were derived by averaging surface current observations by dominant flow regime rather than over time, such as the seasonal averages. This means that the GNOME Model output for each run gives trajectory results specific to one of the three characteristic flow regimes that occur in the SBC-SMB area. The synoptic current fields for these three flow regimes were based on five years of current moored current data and free-floating drifter trajectories. Synoptic current fields, used by the GNOME model, for the relaxation, convergent, and upwelling current flow regimes are illustrated in appendix figures 5.2-2 through 5.2-4 respectively. Further description of these flow regimes can be found in Section 4.4 Physical Oceanography. Results of GNOME model runs are given in terms of estimated barrels of oil beached, location of beaching, barrels floating, barrels weathered (evaporated or dispersed), or barrels moving out of the model domain. Run scenarios are conducted for 200 and 2000 bbl spills over 3 and 10 days. For these more detailed results, please see appendix subsection 5.2.3 Surface Drifter and GNOME Model Data and Analysis.

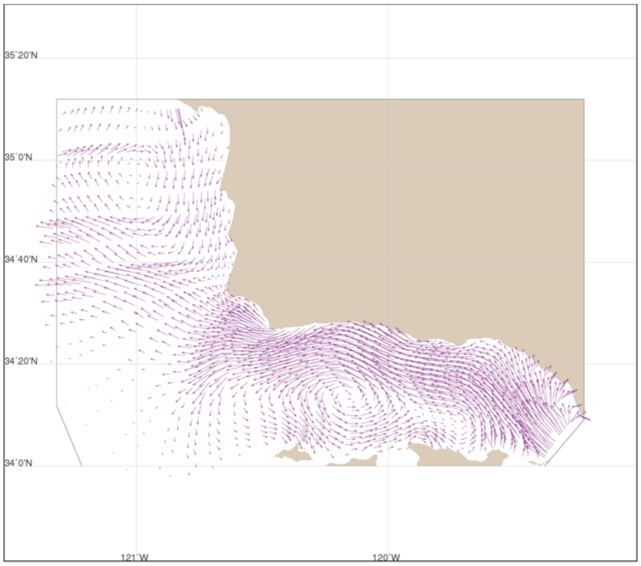
The OSRA Model calculations, the GNOME Model results, and the drifter data provide important insights concerning potential areas affected by an oil spill occurring in the area of proposed activity. The MMS OSRA model gives us seasonal results over a large domain covering the entire affected area. The GNOME model provides oil spill trajectory results based on current flow regimes strongly characteristic of the area. One of these flow regimes is very likely to be occurring during an actual spill event. So the GNOME Model gives us trajectories based on calculations using mean wind and current fields established from analyzing 6 years of data, but over a smaller model domain. The drifter analysis is based on actual field observations and provides information on surface current variability to be considered with the computer-generated results calculated for the SBC-SMB area by the GNOME and OSRA Models. Where the local winds do not dominate, the drifter data like



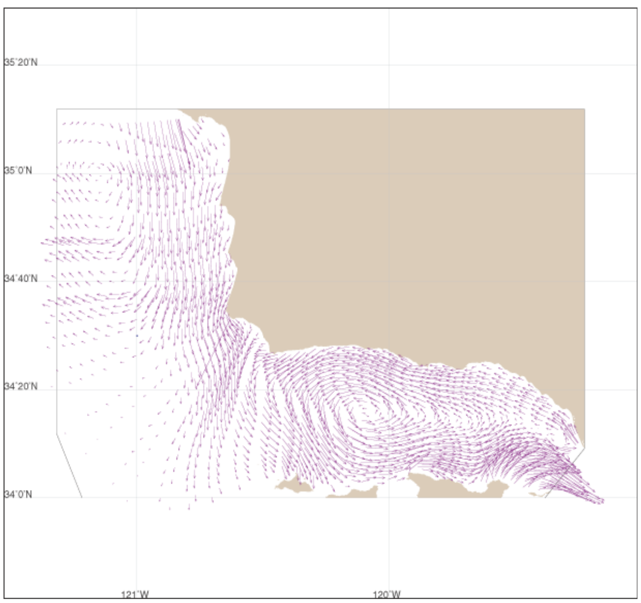

*Appendix Figure 5.2-1. Launch point locations for free-floating surface drifter deployments.*



*Appendix Figure 5.2-2. Synoptic representation of the relaxation current flow regime characteristic of the Santa Barbara Channel-Santa Maria Basin area prepared by Scripps scientists and used by NOAA in their GNOME Model.*

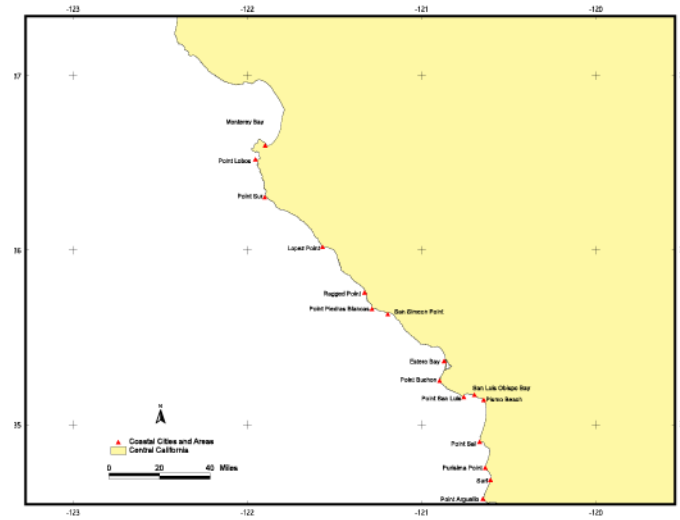



*Appendix Figure 5.2-3. Synoptic representation of the convergent current flow regime characteristic of the Santa Barbara Channel-Santa Maria Basin area prepared by Scripps scientists and used by NOAA in their GNOME Model.*

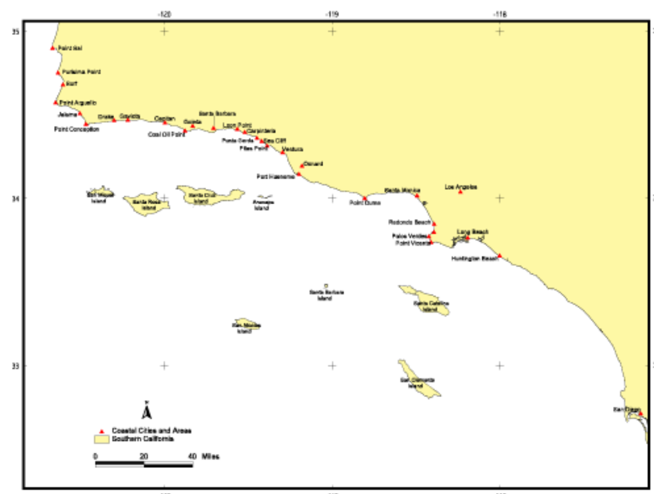



*Appendix Figure 5.2-4. Synoptic representation of the upwelling current flow regime characteristic of the Santa Barbara Channel-Santa Maria Basin area prepared by Scripps scientists and used by NOAA in their GNOME Model.*

the two models, provide reasonably good estimates of the locations of oil spill contacts over the entire affected area. This composite of the three analyses present a more complete picture of what may result from an oil spill event occurring in the area of proposed activity where the current and wind regimes are very complex.




*Appendix Figure 5.2-5. Coastal cities and areas of the central California coastline that are part of the affected area.*




*Appendix Figure 5.2-6. Coastal cities and areas of the southern California coastline that are part of the affected area.*

## APPENDIX 5.2.1 OIL SPILL TRAJECTORY ANALYSES

For the cumulative impact analysis, the geographical limits of the potentially affected area are defined by the farthest locations on the California coastline that could be contacted by oil within 10 days of a spill event occurring in the area of proposed developed activities. The drifter analysis indicates that during an extended period of relaxed winds, the extreme northern boundary of the potentially affected area is Pt. Lobos on the central California coast. The drifters also indicate that during this same wind condition, the northern limits of the area where contact with a spill is "most likely" is Ragged Point, which is further south on the central California coast. Both the drifter and the OSRA Model analyses indicate that both the extreme and "most likely" southern boundaries of the potentially affected area coincide at Santa Catalina Island in the Southern California Bight, and Palos Verdes on the Southern California mainland. Appendix figures 5.2-5 to 5.2-6 depict the potentially affected area.

The aggregate of the three analyses provides both time-dependent and scenario-driven results. The different analyses present results by either 3-month season or by characteristic synoptic flow regime. The frequency and relative dominance of all three flow regimes differ for each calendar month. Appendix table 5.2-2 presents this information determined from 5 years of continuous synoptic current data. The table shows OSRA model seasons defined by calendar month along with the dominant flow regime and relative frequency of occurrence of all flow regimes for each particular month. There is a mix of all three flow regimes for each month, and therefore for each 3-month OSRA season. There is no season where one flow regime is exclusive.

The frequencies that relaxation, upwelling, or convergent flow events occur during winter, as defined above, are 38, 32, and 30 percent of the time respectively. Since the relaxation flow event is only slightly more dominant than the other two, results for all three flow regimes will be reported for the winter season.

The dominant flow regime during the spring, as defined above, is upwelling with a 66 percent frequency of occurrence. Results for this flow regime will be reported for the spring season.

The dominant flow regimes during the summer, as defined above, are convergent and upwelling with a 37 and 35 percent frequency of occurrence respectively. Results for these two flow regimes will be reported for the summer season.

The dominant flow regimes during the fall, as defined above, are relaxation and convergent with a 44 and 40 percent frequency of occurrence, respectively. Results for these two flow regimes will be reported for the fall season.

***Appendix Table 5.2-2. Comparison of seasonal months with the frequency and relative dominance of the three characteristic flow regimes per calendar month (Section 4.4 Physical Oceanography).***

| OSRA Season | Calendar Month | Dominant Flow Regime | Days of Continuous Current Data | Upwelling (%) | Convergent (%) | Relaxation (%) | Other (%) |
|---|---|---|---|---|---|---|---|
| Winter | December | Relaxation | 146.5 | 9.22 | 34.30 | 49.32 | 7.17 |
| Winter | January | Relaxation | 155.0 | 30.16 | 26.13 | 37.42 | 6.29 |
| Winter | February | Upwelling | 141.0 | 51.77 | 26.06 | 19.15 | 3.01 |
| Spring | March | Upwelling | 154.5 | 53.07 | 33.98 | 2.43 | 10.52 |
| Spring | April | Upwelling | 150.0 | 86.00 | 8.83 | 2.67 | 2.50 |
| Spring | May | Upwelling | 155.0 | 47.74 | 32.10 | 14.68 | 5.50 |
| Summer | June | Upwelling | 150.0 | 44.67 | 32.83 | 17.33 | 5.17 |
| Summer | July | Relaxation | 155.0 | 22.42 | 32.10 | 32.90 | 12.58 |
| Summer | August | Convergent | 155.0 | 28.87 | 35.32 | 27.58 | 8,23 |
| Fall | September | Relaxation | 152.0 | 20.07 | 36.35 | 37.99 | 5.59 |
| Fall | October | Convergent | 155.0 | 19.03 | 41.94 | 32.74 | 6.29 |
| Fall | November | Relaxation | 135.0 | 5.37 | 33.52 | 53.15 | 7.96 |

The OSRA, GNOME, and Drifter analyses results are summarized in the composite analysis below for each of the Units listed in appendix table 5.2-1. Complete OSRA Model results are contained in OCS Report MMS2000-057. Examples of OSRA Model output in GIS format for a hypothetical oil spill during each of the 4 seasons at Platforms Hidalgo and Gail are presented in appendix figures 5.2-11 through 5.2-14 and appendix figures 5.2-19 through 5.2-22, respectively. Detailed tabular results of the Drifter and GNOME analyses are contained in appendix subsection 5.2.3 Surface Drifter and GNOME Model Data and Analysis. Examples of GNOME Model output for 2000 bbl spills during for all 3 flow regimes at platforms Hidalgo and Gail are illustrated in appendix figures 5.2-7 through 5.2-10 and appendix figures 5.2-15 through 5.2-18, respectively. Two illustrations for the relaxation flow event, one during a 4 m/s NW wind and one during a 4 m/s SW wind, are included in these illustrations for both platforms. Examples of drifter plots for each of the three flow regimes can be found in appendix figures 5.2-23a and b, 5.2-24a and b, and 5.2-25a and b.

Results from the two models and the drifter data present numbers that are estimates, and therefore the reader is advised to view them as such. OCS Report MMS 2000-057 refers to OSRA Model generated probabilities of contact from hypothetical oil spill trajectories to land segments as estimates. NOAA defines results from GNOME model runs, that are lists numbers of barrels "Evaporated and Disbursed," "Beached," "Off Map"(out of the model domain), and "floating", as a "Best Guess." So the GNOME Model results should not be viewed as precise numbers. Drifter analysis results are from a relatively small data set from a statistical point of view. Therefore the reader is advised to view the percentages attached to drifter data as estimates.

The information provided below list areas that could be contacted by a spill, without consideration for the actual chance of the spill occurring. If a spill were to occur, the chance of shoreline contact and volume of oil contacting shoreline will vary greatly with a number of factors including: location of spill, volume and characteristics of spilled oil, wind and current conditions, sea conditions, and the success of the oil spill containment and response operations.

## LION ROCK UNIT ANALYSES

The Lion Rock Unit is the location of proposed delineation wells. Location SMB-A (appendix table 5.2-1) serves as the launch point for the GNOME and OSRA Model analyses. Drifter launch points 17, 18, 19, and 20 (appendix figure 5.2-1), located offshore Purisima Pt. to Avila Beach in the SMB, were selected as the launch points for the Lion Rock Unit drifter analysis.

During the relaxation flow regime the composite analysis indicates that both computed and observed trajectories are generally directed to the north going with the prevailing poleward current. During the upwelling and convergent flow regimes, trajectories generally head south either well offshore west of the SBC toward the equator or through the SBC and into the south portion of the Southern California Bight.

### Drifter Analysis

Seventy-two trajectories for drifters launched at position numbers 17, 18, 19, and 20 (appendix figure 5.2-1) were analyzed to estimate the possible trajectory of oil during three different flow regimes characteristic to the SMB area. Appendix table 5.2-4 summarizes this data.

During 5 relaxation flow regimes 16 drifters initially traveled north in the SMB while 4 traveled south into the western Southern California Bight (W SCB). Twelve drifters beached at locations as far south as Pt. Sal to as far north as Monterey Bay.

During 4 different Cyclonic flow regimes 15 drifters were successfully deployed. Fourteen went south to south east, 13 of which, entered either the W SCB or SBC. One other drifter proceeded west in the SMB before finally heading south toward the equator. Three drifters made contact with land in their southern journey striking Pt. Sal in the SMB and Pt. Conception and San Miguel Island in the SBC.

During 4 different Upwelling flow regimes 4 of the 15 drifters successfully deployed actually went north, while one went directly east toward the central California coastline. The other 10 drifters went south as expected. Land strikes occurred at Estero Bay, Pt. Buchon, Pismo Beach, Pt. Sal, Santa Monica Bay and San Clemente Island.

### GNOME Analysis for a 200 bbl Oil Spill

For the Lion Rock Unit GNOME runs for a relaxation event, oil beachings occurred only during the NW wind: 1 bbl during the 3-day scenario and 3 bbl during the 10-day scenario. Beachings occurred at Purisima Pt., Pt. Sal, and Pismo Beach. During the 3-day scenarios for all three winds 77 – 79 bbl weathered, 23 – 117 bbl remained floating, and 3 – 100 bbl continued to travel north in the SMB out of the model domain. During the 10-day scenarios for all three winds 77 – 88 bbl weathered, 0 – 3 bbl remained floating, and 106 – 123 bbl of oil continued to travel north in the SMB out of the model domain.

During the Convergent flow regime, 3- and 10-day runs netted 6 and 12 bbl beachings respectively at Purisima Pt., Surf, and Pt. Arguello in the SMB. The 3-day runs produced 79 bbl of oil weathered, 114 bbl of oil floating, and 0 bbl travelling out of the model domain. The 10-day GNOME runs produced 96 bbl of oil weathered 19 bbl of floating oil, and 74 bbl of oil travelling west out of the SMB portion of the model domain.

During the Upwelling flow regime 3- and 10- day runs netted 1 and 50 bbl of oil beached respectively: for the 3-day run beaching occurred at Surf and Pt Arguello, and for the 10- day run, beaching occurred at San Miguel and Santa Rosa Islands. The 3-day runs produced 79 bbl oil weathered, 120 bbl of oil floating, and 0 bbl traveling out of the model domain. The 10-day run produced 95 bbl of weathered oil, 12 bbl of oil floating, and 43 bbl of oil travelling south offshore of the western SBC entrance.

**GNOME Analysis for a 2000 bbl Oil Spill.**

For the Lion Rock Unit GNOME runs for a relaxation event, oil beachings occurred only during the NW wind: 12 bbl during the 3-day scenario and 26 bbl during the 10-day scenario. Beachings occurred at Purisima Pt., Pt. Sal and Pismo Beach. During the 3-day scenarios for all three winds 768 – 788 bbl of oil weathered, 230 – 1174 bbl remained floating, and 28 – 1002 bbl continued to travel north in the SMB out of the model domain. During the 10-day scenarios for all three winds 774 – 880 bbl of oil weathered, 0 – 30 bbl remained floating, and 1064 – 1226 bbl of oil continued to travel north in the SMB out of the model domain.

During the Convergent flow regime, 3- and 10-day runs netted 62 and 118 bbl oil beachings respectively at Purisima Pt., Surf, and Pt. Arguello in the SMB. The 3-day run produced 794 bbl of oil weathered, 1144 bbl of oil floating, and 0 bbl travelling out of the model domain. The 10-day GNOME runs produced 958 bbl of oil weathered, 186 bbl of floating oil, and 738 bbl of oil travelling west out of the SMB portion of the model domain.

During the Upwelling flow regime 3- and 10- day runs netted 8 and 496 bbl of oil beached respectively: for the 3-day run beaching occurred at Surf and Pt Arguello, and for the 10- day run, beaching occurred at San Miguel and Santa Rosa Islands. The 3-day runs produced 794 bbl oil weathered, 1198 bbl of oil floating, and 0 bbl traveling out of the model domain. The 10-day run produced 950 bbl of weathered oil, 122 bbl of oil floating, and 432 bbl of oil travelling south offshore of the western SBC entrance.

**OSRA Model Results**

OSRA Model results are presented in terms of seasons as opposed to current flow regimes where December, January, and February make up the winter season. The results are presented in probability of land fall (in percentage) for a particular USGS quad land segment. If a land segment area is not mentioned it is because the OSRA Model calculation indicates that there is 0 percent probability that oil spilled from the Lion Rock Unit launch point will contact that particular land segment.

The winter 3-day OSRA run for Lion Rock Unit produced a 1 to 2 percent chance of oil spill land strike at Pt Buchon and a 1 to 3 percent chance of land strike at Pt. Arguello. The winter 10-day run produced 1 to 4 percent chance of land strike from San Simeon Pt. to North Estero Bay, 1 to 4 percent probability of land strike at Pt. Buchon, 1 to 3 percent chance of land strike from Pismo Beach to Pt Arguello, and a 1 percent chance of land strike from the western end of Santa Rosa Island to the western end of San Miguel Island.

The spring 3-day OSRA run indicates there is a 2 percent probability of an oil spill land strike at Pt. Arguello and a 2 to 4 percent chance of a land strike at San Miguel Island. The spring 10-day indicates a 1 to 2 percent chance of land strike from Purisima Pt. to Pt. Arguello and a 2 to 13 percent probability of land strike from the western end of Santa Rosa Island to the western tip of San Miguel Island.

The summer 3-day OSRA run indicates there is a 1 percent chance of spilled oil making land contact at Pt. Arguello. The summer 10-day run indicates a 1 percent probability that oil will contact the area between Pt. Sal to Pt. Arguello and a 2 percent probability that the western tip of San Miguel Island will experience oil contact.

The fall 3-day OSRA run indicates there is a 1 percent probability that the area known as Surf, just north of Pt. Arguello, and Pt Arguello itself will experience oil contact. The fall 10- day OSRA run indicates there is a 1 percent probability that oil will contact Pt. Buchon, the shoreline between Pt. Sal to Pt. Arguello, and the western half of San Miguel Island.

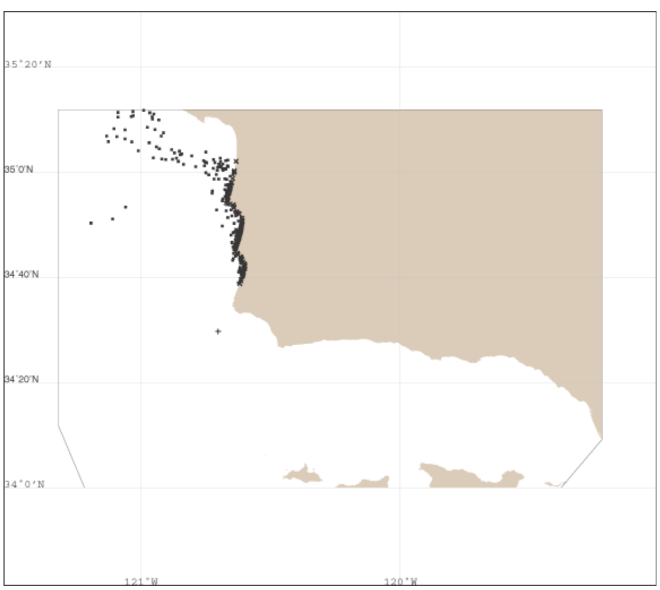
**POINT ARGUELLO UNIT ANALYSES.**

The Point Arguello Unit is the general location of Platforms Hidalgo, Harvest, and Hermosa which serve as launch points for the GNOME and OSRA Model analyses. Examples of GNOME Model output for 2000 bbl spills during for all 3 flow regimes at platforms Hidalgo are illustrated in appendix figures 5.2-7 through 5.2-10. An example of OSRA Model output in GIS format for a hypothetical oil spill during each of the 4 seasons at Platform Hidalgo is presented in figures 5.2-11 through 5.2-14. Drifter launch points 12, 13, 14, and 15 (appendix figure 5.2-1), located offshore Pt. Arguello and Pt. Conception in the transition area between the SMB and the SBC, were selected as the launch points for the San Ynez Unit drifter analysis.

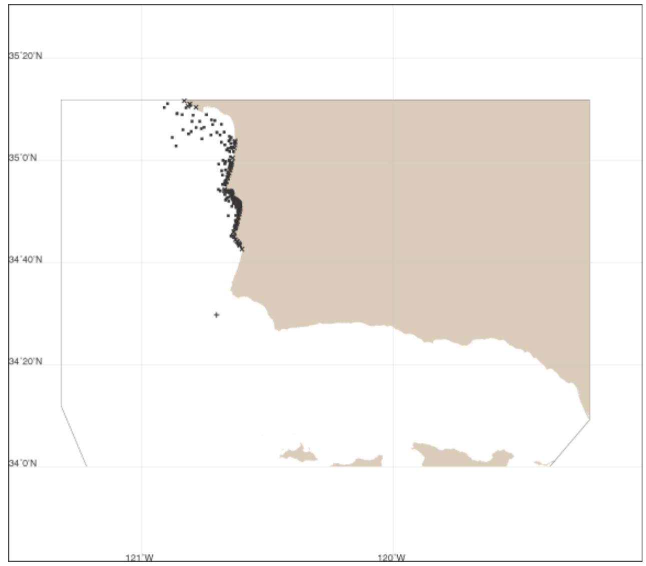
During the relaxation flow regime the composite analysis indicates that trajectories are generally directed to the north along the central California coat along with the prevailing poleward current. During the upwelling flow regime the trajectories generally head either south-southeast through the western island passes of the SBC or south, offshore of the western SBC, toward the equator. During the convergent flow regime, trajectories generally head west, well offshore the SBC.

### Drifter Analysis

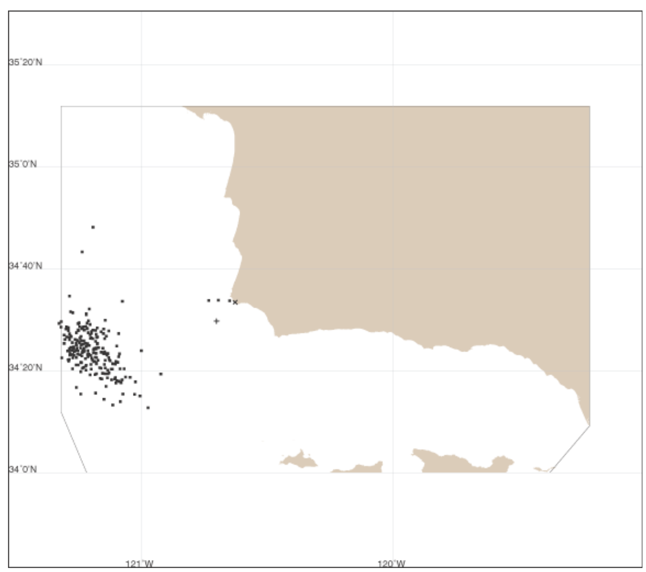
The following is a summary of "Surface Drifter Analysis for the Rocky Point Unit Project Oil Spill Risk Assessment" which is included in its entirety in appendix subsection 5.2.3, appendix exhibit 5.2-1. It contains both a non-seasonal and seasonal analysis of drifter trajectory for drifters launched at locations 12, 13, 14, and 15 (appendix figure. 5.2-1) in the Point Arguello Unit area. The seasonal analysis, as opposed to one done according to the three major flow regimes characteristic of the SBC-SMB area, was conducted to effect a more precise comparison between the OSRA Model results and actual free-floating drifter trajectory results. References to figures in the remaining Point Arguello Unit drifter analysis text refers to figures included in the above titled document located in appendix subsection 5.2.3, appendix exhibit 5.2-1.



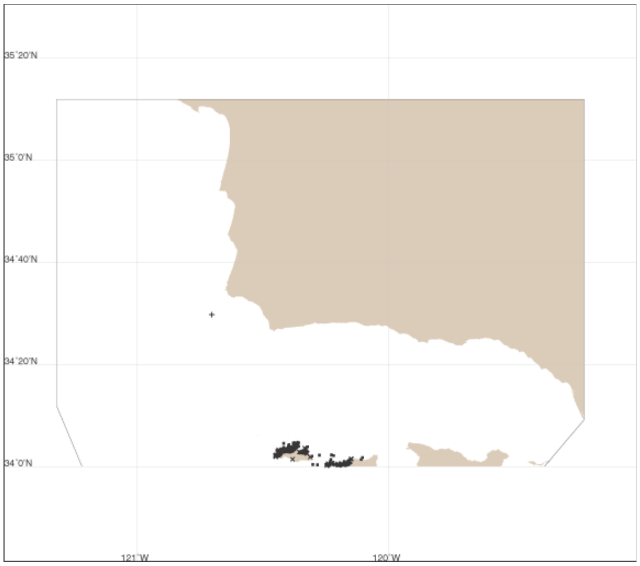

***Appendix Figure 5.2-7. GNOME Modeled 10 day, 2000 bbl oil spill scenario for platform Hidalgo (depicted by "+"), located offshore of Point Arguello, during a relaxation flow regime and a 4 m/s NW wind. GNOME model output indicates that of 2000 bbl released: 358 bbl beach, 950 bbl evaporate or are dispersed, 318 bbl are still floating, and 374 bbl have moved out of the model domain heading north in the Santa Maria Basin.***



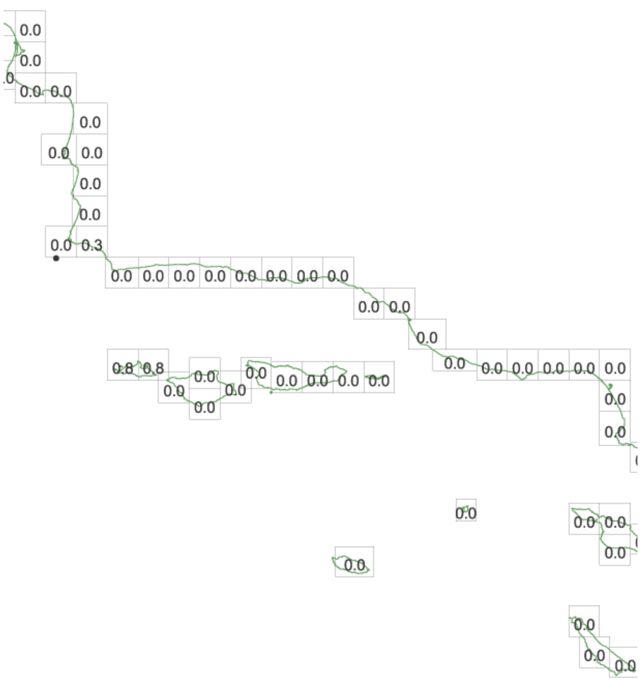

***Appendix Figure 5.2-8. GNOME Modeled 10 day, 2000 bbl oil spill scenario for platform Hidalgo (depicted by "+"), located offshore of Point Arguello, during a relaxation flow regime and a 4 m/s SW wind. GNOME model output indicates that of 2000 bbl released: 296 bbl beach, 942 bbl evaporate or are dispersed, 220 bbl are still floating, and 542 bbl have moved out of the model domain heading north in the Santa Maria Basin.***



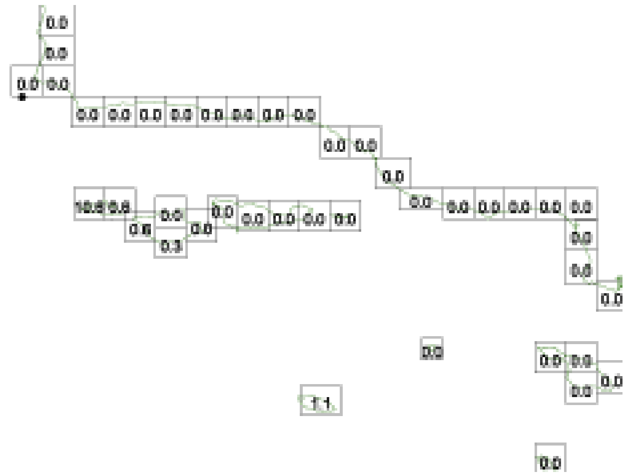

***Appendix Figure 5.2-9. GNOME Modeled 10 day, 2000 bbl oil spill scenario for platform Hidalgo (depicted by "+"), located offshore of Point Arguello, during a convergent flow regime and a 7m/s NW wind. GNOME model output indicates that of 2000 bbl released: 2 bbl beach, 946 bbl evaporate or are dispersed, 446 bbl are still floating, and 606 bbl have moved out of the model domain heading west out of the Santa Maria Basin.***



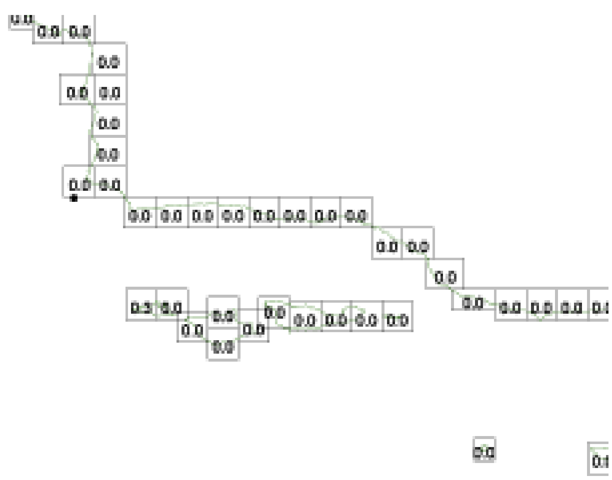

***Appendix Figure 5.2-10. GNOME Modeled 10 day, 2000 bbl oil spill scenario for platform Hidalgo (depicted by "+"), located offshore of Point Arguello, during an upwelling flow regime and a 8m/s NW wind. GNOME model output indicates that of 2000 bbl released: 596 bbl beach, 974 bbl evaporate or are dispersed, 128 bbl are still floating, and 302 bbl have moved out of the model domain heading south to southeast offshore of the Southern California Bight.***




***Appendix Figure 5.2-11. MMS OSRA Model output for a 10 day event at platform Hidalgo during the winter season. The boxes are U. S. Geological Survey 7.5 Minute Quad series maps presenting the calculated probabilities (in percentages) of oil contact with the shoreline contained within each map.***



***Appendix Figure 5.2-12. MMS OSRA Model output for a 10 day event at platform Hidalgo during the spring season. The boxes are U. S. Geological Survey 7.5 Minute Quad series maps presenting the calculated probabilities (in percentages) of oil contact with the shoreline contained within each map.***



***Appendix Figure 5.2-13. MMS OSRA Model output for a 10 day event at platform Hidalgo during the summer season. The boxes are U. S. Geological Survey 7.5 Minute Quad series maps presenting the calculated probabilities (in percentages) of oil contact with the shoreline contained within each map.***

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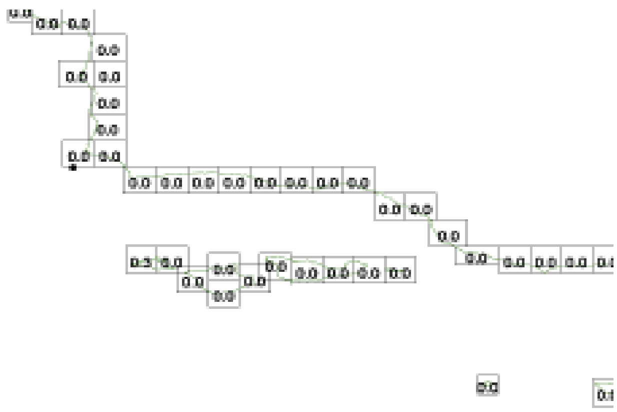


***Appendix Figure 5.2-14. MMS OSRA Model output for a 10 day event at platform Hidalgo during the fall season. The boxes are U. S. Geological Survey 7.5 Minute Quad series maps presenting the calculated probabilities (in percentages) of oil contact with the shoreline contained within each map***

Trajectories of drifters launched from four locations in the proximity of the Rocky Point area (Deployments Sites 12, 13, 14, and 15, Figure D.1) were examined, described (Table D.1), and categorized according to dominant/effective direction, dominant/effective direction by season, final direction, and whether shoreline contact was made. Examination of all drifter tracks advecting through the Rocky Point area, regardless of their origin, is deferred for later analysis. If no trajectory data existed for a launch point during a particular deployment, no attempt was made to fill that data break with trajectory data from another drifter launch point. There were a total of 65 successful drifter launches from all four locations during the 6 years of deployments. There were 27 successful launches at one location, 12 successful launches at another, and 13 at each of the other two launch points.

**Non-Seasonal Analysis.**

The dominant/effective direction of a drifter trajectory is defined as the direction the drifter traveled in the proximity of the SBC and SMB area, or its direction prior to its contact (or near contact) with a shoreline. When looking at the totals over all deployments (Table D.2), irrespective of season or flow regime, the tendency for a drifter to travel north, west, or south is about even with a slight edge to the northerly direction (around Points Conception and Arguello and up the central California coast) at 32.3 percent of all drifter trajectories. The southerly direction was second in dominance with 30.8 percent of all trajectories, and the west was third with 27.7 percent of all trajectories. The tendency to go east accounted for 9.2 percent of all trajectories.

Drifters that went north were twice as likely to strike the shoreline as those that went south. Two thirds of the drifters that traveled north made contact with the shoreline, whereas only one third of the drifters travelling south experienced the same fate. Two thirds of the drifters traveling east made contact with the shoreline. No drifters traveling west ever made contact with land, even after becoming entrained in the equatorward California Current.

When looking at the final direction of all drifter trajectories (Table D.3), again irrespective of season or flow regime, the California Current system comes into play with a clear dominance in direction to the south at 66.2 percent of all trajectories. The north is second at 26.2 percent of all trajectories, then the west at 4.6 percent and finally the east at 3.1 percent. Since all trajectories represent 40 days of transmitting data, the category of "final direction" of free floating surface drifters is probably the least important to oil spill trajectory. The effect of weathering on oil makes the first 10 days of the oil spill trajectory the most important in a risk analysis.

In looking at drifter contact with the shoreline, a drifter can contact the shore without necessarily beaching there. A drifter can, and usually does, travel offshore after making contact with land to yet a new fate. This analysis limits the definition of shoreline contact of a drifter to first contact with a beach. First contact means the first location at which a drifter made actual contact with the shoreline or was close enough that, if it were oil, oil spill response experts and the public alike would consider it a land strike. For the purposes of comparing shoreline contacts in the north versus those in the south (Table D.4), north is defined as the shoreline from Pt. Conception north. South is defined as all shoreline areas south and east of Pt. Conception. The results of this analysis are that 23.1 percent of all trajectories made shoreline contact in the north as opposed to 15.4 percent of all trajectories making shoreline contact to the south. In other words, 60 percent of all drifters launched from the Rocky Point area that contacted the shoreline, made landfall along the central California coast from Pt. Conception northward.

**Seasonal Analysis**

The seasonal organization of months matches the seasonal synoptic current maps provided to the MMS from the SBC-SMBC Study as input to MMS's OSRA Model. These seasonal current maps are statistical representations of both drifter current data and current data obtained from moorings that were deployed as part of the study's field program. Thus, to provide consistency, the 6 years of drifter deployments are grouped according to their months of deployment into the same seasons as defined for the OSRA Model.

**Spring Season (March – May):** There were 19 drifters successfully launched from the four launch points in the proximity of Rocky Point during the spring (Table D.5). Drifters tended to go south 47.4 percent of the time in the spring, with 33.3 percent of those drifters making shoreline contact. The second most dominant direction was east claiming 26.3 percent of the trajectories with a 60-percent shoreline contact rate. Drifters moved toward the west 15.8 percent of the time, with no drifters making contact with a beach. Drifters moved to the north only 10.5 percent of the time, but with a 100-percent shoreline contact rate.

**Summer Season (June – August):** There were 16 drifters successfully launched from the proximity of Rocky Point during the summer (Table D.5). The west is the most dominant direction for drifter trajectory in the summer, accounting for 43.8 percent of the total, but with no shoreline contact. The second most frequent direction for drifter movement was the south, with 31.25 percent of drifter trajectory and a shoreline contact rate of 20 percent. Drifters advected to the north 25 percent of the time with a 50-percent shoreline contact rate. No drifters moved to the east during the summer.

**Fall Season (September – November):** There were 21 drifters successfully launched from the four launch points in the proximity of Rocky Point during the fall (Table D.6). Drifters tended to go to the north 47.6 percent of the time, with 60 percent of them making contact with the shoreline. Another 23.8 percent of the launches made during this season went south, making contact with the shoreline 60 percent of the time. Drifter trajectories toward the west accounted for another 23.8 percent of the total number of launches, but with no shoreline contacts. Only one drifter launched (4.8 percent of the trajectories) during the fall advected to the east; this drifter also made shoreline contact.

**Winter Season (December – February):** There were 9 drifters successfully launched from the proximity of Rocky Point during the winter (Table D.6). Drifters tended to go north 55.6 percent of the time with an 80-percent shoreline contact rate. Drifters advected south only 11.1 percent of the time with no shoreline contact. The westerly direction was the second most prominent direction for drifter movement during the winter, claiming 33.3 percent of the drifters launched, again with none making shoreline contact. There were no drifter trajectories toward the east during the winter.

**Seasonal and Non-Seasonal Summary**

The drifter data and analysis above provide a measure of the likelihood that a drifter, and therefore probably a surface floating pollutant, will be transported in a certain direction. Because of the small number of drifter observations, the calculated percentage (probability) that a drifter will move in a certain direction, or make contact with a shoreline should be viewed cautiously. However, based on the drifter data it can be surmised that a surface floating pollutant originating in the Rocky Point area has an equal likelihood of moving north, west, or south. If the pollutant were to move in the northerly, southerly, or easterly direction, then there also would be a reasonable possibility of shoreline contact. A surface pollutant spill originating from Rocky Point would be likely to move north or west during the fall and winter, south and east in the spring, and west and south in the summer. This is because the relaxation and cyclonic circulation flow regimes are dominant in the fall and winter, the upwelling circulation flow regime is dominant in the spring, and the cyclonic circulation flow regime is dominant in the summer. The uncertainty of direction of movement of a drifter (or a surface pollutant) during a particular season is due to the fact that all of these oceanic flow regimes (including their transition states) characteristic of the SBC-SMB area can occur during any time of the year.

**GNOME Analysis for a 200 bbl Oil Spill**

The GNOME launch points from the Pt. Arguello Unit consists of the locations of three existing Platforms: Hidalgo, Harvest, and Hermosa. The GNOME results for all three will be combined and summarized here.

For all three wind scenarios for the 3-day Relaxation flow regime excursion, 0-8 bbl of oil beached on the Pt. Sal, Purisima Pt. and Surf shorelines. Additionally, 79 bbl of oil weathered, 112 –121 bbl of oil remained floating, and 0 bbl traveled out of the domain for all three wind scenarios. For the 10-day three-wind Relaxation scenarios 1-35 bbl beached on Pt. San Luis, Pismo Beach, Pt. Sal, Purisima Pt., and Surf. Additionally, 93-97 bbl of oil weathered, 6-33 bbl of oil remained floating, 36-101 bbl of oil traveled north in the SMB out of the model domain.

During the Convergent flow regime, 3 and 10 day scenarios collectively resulted in 1 bbl of oil beaching on the shoreline of Pt Arguello. During the 3-day scenario 79 bbl of oil weathered, 120-121 bbl of oil remained floating, and 0 bbl of oil traveled out of the model domain. During the 10-day event 95-96 bbl of oil weathered, 43-72 bbl of oil remained floating, and 32-61 bbl of oil traveled west and southwest in the SMB out of the model domain.

During the Upwelling flow regime, the 3-day scenario yielded 32-57 bbl of oil beaching on the shorelines of San Miguel and Santa Rosa Islands. Additionally, 79 bbl of oil weathered, 63-88 bbl of oil remained floating, 1-2 bbl of oil traveled south offshore the western SBC entrance out of the model domain. During the 10-day scenario 57-60 bbl of oil beached San Miguel and Santa Rosa Islands, 95-96 bbl of oil weathered, 10-14 bbl of oil remained floating, and 31-36 bbl of oil south offshore the western SBC entrance out of the model domain.

**GNOME Analysis for a 2000 bbl Oil Spill**

The GNOME launch points from the Pt. Arguello Unit consists of the locations of three existing Platforms: Hidalgo, Harvest, and Hermosa. The GNOME results for all three will be combined and summarized here.

For all three wind scenarios for the 3-day Relaxation flow regime excursion, 0-86 bbl of oil beached on the Pt. Sal, Purisima Pt. and Surf shorelines. Additionally, 794 bbl of oil weathered, 112 0–1206 bbl of oil remained floating, and 0 bbl traveled out of the domain for all three wind scenarios. For the 10-day three-wind Relaxation scenarios 2-358 bbl beached on Pt. San Luis, Pismo Beach, Pt. Sal, Purisima Pt., and Surf. Additionally, 920-972 bbl of oil weathered, 52-322 bbl of oil remained floating, 374-1026 bbl of oil traveled north in the SMB out of the model domain.

During the Convergent flow regime, 3 and 10 day scenarios resulted in 4 and 6 bbl of oil respectively beaching on the shoreline of Pt Arguello. During the 3-day scenario 794 bbl of oil weathered, 1200-1206 bbl of oil remained floating, and 0 bbl of oil traveled out of the model domain. During the 10-day event 950-962 bbl of oil weathered, 432-716 bbl of oil remained floating, and 322-614 bbl of oil traveled west and southwest in the SMB out of the model domain.

During the Upwelling flow regime, the 3-day scenario yielded 324-566 bbl of oil beaching on the shorelines of San Miguel and Santa Rosa Islands. Additionally, 792 bbl of oil weathered, 630-880 bbl of oil remained floating, 4-20 bbl of oil traveled south offshore the western SBC entrance out of the model domain. During the 10-day scenario 572-598 bbl of oil beached San Miguel and Santa Rosa Islands, 950-964 bbl of oil weathered, 104-144 bbl of oil remained floating, and 308-362 bbl of oil south offshore the western SBC entrance out of the model domain.

**OSRA Model Results**

The winter 3-day OSRA Model runs for the three Point Arguello Unit platforms yielded a 1 percent probability of oil spill landfall at Pt Arguello and the western end of San Miguel Island. The winter 10-day run yielded a 1 percent probability of landfall at Ragged Point near the Monterey and San Luis Obispo county lines, a 1 percent probability of shoreline contact at Point Arguello, and a 1 to 2 percent probability of shoreline contact at San Miguel and Santa Rosa Islands.

The spring 3-day runs resulted in a 10 to 22 percent probability of shoreline contact at San Miguel Island and a 3 percent probability of oil spill contact with Santa Rosa Island. The spring 10-day runs yielded an 11 to 22 percent probability of oil spill contact at San Miguel Island, a 1 percent chance of contact with north and south Santa Rosa Island, and a 1 percent probability of contact with San Nicholas Island.

The summer 3-day runs produced a 1 to 2 percent probability of oil contact with the western end of San Miguel Island. The summer 10-day runs produced similar results, a 0 to 2 percent probability of landfall at the western end of San Miguel Island.

The fall 3-day runs yielded a 1 to 2 percent probability of oil spill contact with the western end of San Miguel Island. The fall 10-day runs also yield a 1 to 2 percent probability of oil spill contact with western shoreline of San Miguel Island.

**SANTA YNEZ UNIT ANALYSES.**

The San Ynez Unit is the general location of Platforms Heritage, Harmony, and Hondo which serve as launch points for the GNOME and OSRA Model analyses. Drifter launch points 5, 6, 7, and 8 (appendix figure 5.2-1), located in the northwest and north central area of the SBC, were selected as the launch points for the San Ynez Unit drifter analysis.

During the relaxation flow regime the composite analysis indicates that trajectories are primarily directed to the west along the northern shoreline of the SBC and out its western entrance where one to three events occur: (1) they turn the corner at Point Arguello where they proceed north along the central California coast, (2) they continue west further offshore, and/or (3) they turn south to southeast toward the Baja or the San Miguel, Santa Rosa, and possibly the Santa Cruz Islands. Other trajectories will head west, south west, or southeast toward the western Channel Islands.

During the convergent flow regime the composite analysis indicates that primarily the trajectories initially go west along the SBC mainland, but then become entrained in the cyclonic gyre in the western end of the SBC where they eventually re-enter the SBC heading in a southwesterly direction. The few trajectories that escape the western SBC will either go north along the central California coast, continue west toward the central Pacific, or go southwest toward the Baja. The majority of trajectories remain in the SBC within the cyclonic gyre or turn Southeast toward the three western-most Channel Islands.

During the upwelling flow regime the composite analysis indicates that most trajectories become entrained in the SBC's western cyclonic gyre, but then continue in a southeasterly direction heading toward either the easternmost two Channel Islands or out of the eastern SBC entrance along the Southern California Bight coastline.

**Drifter Analysis**

One hundred and four trajectories for drifters launched at position numbers 5, 6, 7, and 8 (appendix figure 5.2-1) were analyzed to estimate the possible trajectory of oil during three different flow regimes characteristic to the SMB area. Appendix table 5.2-3 summarizes this data.

During 6 Relaxation flow events 22 drifters initially traveled west in the SBC while 1 traveled south to San Miguel Island and the other traveled northwest to Capitan at the SBC mainland. Of the 22 drifters that traveled west and exited the SBC, 13 turned north and traveled along the central California Coastline. Six other drifters traveled south to southeast into the SCB, and 1 drifter continued travelling west in the western SMB. Fourteen of the 24 drifters launched beached at (from north to south): Monterey Bay, Lopez Pt., Pt. Sur north, Pt. Sur, Cambria, Pt. Sal, Santa Maria River mouth, Surf, and Pt. Arguello in the SMB; Drake, Capitan, and San Miguel Island in the SBC; and San Nicolas Island in the SCB.

During 10 Cyclonic flow events 13 drifters initially traveled west, 18 drifters went southeast to southwest, 5 drifters went Northwest to northeast, and 1 drifter went east. Most of the drifters cycled in the SBC, but three escaped out of the western SBC entrance. Two of the 3 traveled north in the SMB and one traveled south into the SCB. Twenty of the 37 drifters launched beached at: Purisima Pt in the SMB; Capitan, Drake, Gaviota, Coal Oil Pt., and Sea Cliff along the SBC mainland; and San Miguel, Santa Rosa, and Santa Cruz Islands.

During 10 Upwelling flow events 21 drifters initially traveled southeast, 7 drifters traveled south, 8 drifters traveled west, 3 drifters traveled east, 2 drifters traveled northeast, and one drifter traveled northwest. Three drifters escaped the SBC via its western entrance: one proceeded north along the central California coast in the SMB, the other 2 turned south in the western SCB. Many others escaped the SBC through its eastern entrance continuing in a southeast direction into the SCB offshore of Los Angeles. Nineteen of the 40 drifters launched beached at: Pismo Beach in the SMB; Santa Barbara, Coal Oil Pt., Ventura, Oxnard, Pt. Mugu along the SBC mainland; San Miguel, Santa Cruz, and Anacapa Islands in the SBC; and Santa Monica, Palos Verdes, Redondo Beach along the southern California coastline in the SCB.

**GNOME Analysis for a 200 bbl Oil Spill**

The GNOME launch points from the Santa Ynez Unit consists of the locations of three existing Platforms: Heritage, Harmony, and Hondo. The GNOME results for all three will be combined and summarized here.

For all three wind scenarios for the 3-day Relaxation flow regime excursion, 1-5 bbl of oil beached on the Pt. Arguello and Surf shorelines. Additionally, 79-80 bbl of oil weathered, 116 –121 bbl of oil remained floating, and 0 bbl traveled out of the domain for all three wind scenarios. For the 10-day three-wind Relaxation scenarios 1-33 bbl beached on Pt. San Luis, Pismo Beach, Pt. Sal, Purisima Pt., and San Miguel, Santa Rosa, and Santa Cruz Islands. Additionally, 96-98 bbl of oil weathered, 18-73 bbl of oil remained floating, 14-79 bbl of oil traveled north in the SMB, west in the SMB, and south in the SBC to move out of the model domain.

During the Convergent flow regime, 3-day scenarios resulted in 6-24 bbl of oil beaching on the shorelines of San Miguel, Santa Rosa, and Santa Cruz Islands. During the 3-day scenarios 79 bbl of oil weathered, 96-115 bbl of oil remained floating, and 0 bbl of oil traveled out of the model domain. During the 10-day event 48-53 bbl of oil beached on the shorelines of San Miguel, Santa Rosa, and Santa Cruz Islands, 95-96 bbl of oil weathered, 15-18 bbl of oil remained floating, and 33-41 bbl of oil traveled south to the SCB and out of the model domain.

During the Upwelling flow regime, the 3-day scenario yielded 1-20 bbl of oil beaching on the shoreline of Santa Cruz Islands. Additionally, 79 bbl of oil weathered, 101-120 bbl of oil remained floating, and 0 bbl of oil traveled out of the model domain. During the 10-day scenario 2-11 bbl of oil beached on Santa Cruz Island and Ventura, 88-90 bbl of oil weathered, 5-6 bbl of oil remained floating, and 95-103 bbl of oil traveled southeast out the eastern SBC entrance toward the SCB and out of the model domain.

**GNOME Analysis for a 2000 bbl Oil Spill**

The GNOME launch points from the Santa Ynez Unit consists of the locations of three existing Platforms: Heritage, Harmony, and Hondo. The GNOME results for all three will be combined and summarized here.

For all three wind scenarios for the 3-day Relaxation flow regime excursion, 14-50 bbl of oil beached on the Pt. Sal, Purisima Pt., Surf and Pt.

Arguello shorelines. Additionally, 794 bbl of oil weathered, 1156 –1206 bbl of oil remained floating, and 0 bbl traveled out of the domain for all three wind scenarios. For the 10-day three-wind Relaxation scenarios 8-324 bbl beached on Pt. San Luis, Pismo Beach, Pt. Sal, Purisima Pt., and San Miguel, Santa Rosa, and Santa Cruz Islands. Additionally, 950-976 bbl of oil weathered, 180-782 bbl of oil remained floating, 144-786 bbl of oil traveled north in the SMB, west in the SMB, and south offshore the western SBC entrance to the SCB to move out of the model domain.

During the Convergent flow regime, 3-day scenarios resulted in 56-244 bbl of oil beaching on the shorelines of San Miguel, Santa Rosa, and Santa Cruz Islands. Additionally, 786-794 bbl of oil weathered, 956-1150 bbl of oil remained floating, and 0-14 bbl of oil traveled south to the SCB and out of the model domain. During the 10-day event 482-532 bbl of oil beached on the shorelines of San Miguel, Santa Rosa, and Santa Cruz Islands, 954-964 bbl of oil weathered, 152-176 bbl of oil remained floating, and 366-614 bbl of oil traveled south to the SCB and out of the model domain.

During the Upwelling flow regime, the 3-day scenario yielded 8-198 bbl of oil beaching on the shorelines of Santa Rosa and Santa Cruz Islands. Additionally, 790-794 bbl of oil weathered, 1008-1198 bbl of oil remained floating, and 0-4 bbl of oil traveled south to the SCB and out of the model domain. During the 10-day scenario 18-112 bbl of oil beached on Santa Cruz Island and Ventura, 882-898 bbl of oil weathered, 50-60 bbl of oil remained floating, and 954-1032 bbl of oil traveled southeast out the eastern SBC entrance toward the SCB and out of the model domain.

### OSRA Model Analysis

The winter 3-day OSRA Model runs for the three San Ynez Unit platforms indicate a 2 to 13 percent probability of oil spill landfall from Gaviota to Pt Arguello and a 3 to 14 percent probability of shoreline contact at the western end of Santa Cruz Island to the central north shoreline of Santa Rosa Island to a 9 percent probability of landfall at San Miguel Island. The winter 10-day OSRA Model runs indicates a 2 to 13 to 12 to 1 percent probability that oil spill landfall will occur at Gaviota, Drake, Pt. Conception, and Pt. Arguello respectively. The winter 10-day run also indicates a 1 to 19 to 12 percent probability that landfall will occur at the Islands of Santa Cruz, Santa Rosa, and San Miguel respectively.

The spring 3-day runs indicate as high as a 2 percent probability of shoreline contact at the eastern end of Santa Cruz Island to Anacapa Island to a 52 percent probability of landfall at the western end of Santa Cruz Island. Probability of landfall as high as 10 percent is indicated for Santa Rosa Island. The spring 10-day runs indicate a 6 to 18 to 56 to 11 to 1 percent probabilities of oil spill landfall at the north shorelines of Anacapa, east Santa Cruz, west Santa Cruz, Santa Rosa, and San Miguel Islands respectively.

The summer 3-day runs indicate a 25 to 59 to 5 percent probability of shoreline contact at western Santa Cruz, Santa Rosa, and San Miguel Islands respectively. The summer 10-day runs indicate a 1 to 3 to 42 to 60 to 5 percent probability of oil spill contact with the shorelines of Anacapa, eastern Santa Cruz, western Santa Cruz, and San Miguel Islands respectively.

The fall 3-day runs indicate a 1 percent probability of landfall at Pt. Conception and 8 to 28 to 8 percent probability of landfall at the western Santa Cruz, Santa Rosa, and San Miguel Islands respectively. The fall 10-day runs indicate a 1 percent probability of landfall at Pt. Conception. The fall 10-day runs indicate a 1 to 21 to 34 to 11 percent probability of oil spill contact at the shorelines of eastern Santa Cruz, western Santa Cruz, Santa Rosa, and San Miguel Islands.

## PLATFORM HILLHOUSE AND SANTA CLARA UNIT ANALYSES.

Platform Hillhouse, located in the northeastern Channel, and Platform Gail, located in the Santa Clara Unit, were used as the launch points for the GNOME and OSRA Model analyses. While GNOME and OSRA Model results are presented separately for each of these launch points the Cavern Point Project drifter analysis will be used for both Units.

### Drifter Analysis

The following is a summary of "Surface Drifter Analysis for the Cavern Point Unit Project Oil Spill Risk Assessment" which is included in its entirety in appendix subsection 5.2.3, appendix exhibit 5.2-2. It contains both a non-seasonal and seasonal analysis of drifter trajectory for drifters launched at locations 1, 2, 3, and the eastern Channel entrance (E.CE; appendix figure 5.2-1) in the Santa Clara Units and at Platform Hillhouse. The seasonal analysis, as opposed to one done according to the three major flow regimes characteristic of the SBC-SMB area, was conducted to effect a more precise comparison between the OSRA Model results and actual free-floating drifter trajectory results. References to figures in the remaining Platform Hillhouse-Santa Clara Units drifter analysis text refers to figures included in the above titled document located in appendix section 5.2.3, appendix exhibit 5.2-2.

The drifter data and analysis below provide a measure of the likelihood that a drifter and, therefore, possibly an oil spill, will be transported in a certain direction. Because of the small number of drifter observations, the calculated percentage (probability) that a drifter will move in a certain direction, or make contact with a shoreline, should be viewed with caution.

Trajectories of drifters launched from four locations in the proximity of the Cavern Point area (Deployment Sites 1, 2, 3, and E.CE, Figure 1) were examined, described (Table 1), and categorized according to dominant/effective direction, dominant/effective direction by season, final direction, shoreline contact in major areas, final location, final location by season, and whether shoreline contact was made. Examination of all drifter tracks advecting through the Cavern Point area, regardless of their origin, is deferred for later analysis. If no trajectory data existed for a launch point during a particular deployment, no attempt was made to fill that data break with trajectory data from another drifter launch point. There were a total of 85 successful drifter launches from all four locations during the 6 years of deployments. There were 31 successful launches at one location, 26 successful launches at another, 24 launches at another and 4 at the E.CE.

Shoreline contact will be part of the discussion. Actual shoreline contact is many times subject to small scale local environmental events. However, the fact that a free floating drifter has moved to a certain coastal region indicates the associated onshore and offshore resources in that area are in jeopardy should a real spill occur.

## Non-Seasonal Analysis

The dominant/effective direction of a drifter trajectory is defined as the direction the drifter traveled in the proximity of the SBC and SMB area, or its direction prior to its contact (or near contact) with a shoreline. When looking at the totals over all deployments (Table 2), irrespective of season or flow regime, we see that the tendency is greatest (35.3% of all 85 drifters) to travel southeast toward, and out, the eastern Channel entrance. The westerly direction is second at 24.7%, north is third at 14.1%, south is fourth at 11.8%, and northwest along the central California coast is fifth at 10.6% . The easterly direction accounts for only 3.5%. A startling statistic is that over 82% of all drifters launched in the Cavern Point area made landfall or came near a shoreline.

In looking at drifter contact with the shoreline, a drifter can contact the shore without necessarily beaching there. A drifter can, and usually does, travel offshore after making contact with land to yet a new fate. This analysis limits the definition of shoreline contact of a drifter to first contact with a beach. First contact means the first location at which a drifter made actual contact with the shoreline or was close enough that, if it were oil, oil spill response experts and the public alike would consider it a land strike. Table 7 does present the degree of multiple shoreline contacts in different areas during a single drifter trajectory.

In Table 4 a comparison of the number of drifter shoreline contacts in each of three main areas is made. Over 47% of all launches made land strike at the Channel Islands, or at shorelines immediately south in the Southern California Bight. Over 27% of launches struck the Channel mainland, and 8.2% of all drifters launched in the Cavern Point area made land strike along the central California coast.

When looking at the final direction of all drifter trajectories (Table 3), again irrespective of season or flow regime, the south toward the Channel Islands and the southeast out the eastern Channel entrance dominated at 29.4% for each direction or a composite of 58.8% of all drifters. West was the final direction for 15.3% of all drifters, north toward the mainland was the final direction for 12.9% of all of the drifters, northwest along the central California coast was the final direction for 11.8% of all of the drifters launched, and the east was the final direction for 2.4% of all the drifters launched from the Cavern Point area. Since all trajectories represent 40 days of transmitting data, the category of "final direction" of free floating surface drifters is probably the least important to oil spill trajectory. The effect of weathering on oil makes the first 10 days of the oil spill trajectory the most important in a risk analysis.

Final distribution of the 85 drifters launched from the Cavern Point area (Table 5) consists of 35.3% remaining in the SBC, 29.4% exiting the Channel and finishing their reported trajectory in the western region of the Southern California Bight, 23.5% end their journey in the coastal region of the Southern California Bight, 11.8% traveled northwest along the central California coast before striking its shoreline or stop reporting, and 3.6% exit out of the eastern Channel entrance and then go west striking the southern shorelines of the Channel Islands.

## Seasonal Analysis

The seasonal organization of months matches the seasonal synoptic current maps provided to the MMS from the SBC-SMBC Study as input to MMS's OSRA Model. These seasonal current maps are statistical representations of both drifter current data and current data obtained from moorings that were deployed as part of the study's field program. Thus, to provide consistency, the 6 years of drifter deployments are grouped according to their months of deployment into the same seasons as defined for the OSRA Model.

There are two major non-local forcing mechanisms affecting the oceanic flows in the SBC-SMB area: the upwelling-favorable macroscopic wind regime (from the northwest along the western United States coastline) and the poleward alongshore pressure gradient in the Southern California Bight. There are also some local forcing mechanisms that modify the larger flow regime that is set in place by the relative balance of these two larger scale oceanic forcing mechanisms. While the dominant flow regime for each season is discussed, the other flow regimes characteristic to the SBC-SMB area can occur during that same season which, in that instance, would dictate the trajectory of spilled oil.

**Spring Season (March – May):** The dominant flow regime during the spring season is the upwelling flow regime. Upwelling favorable winds (from the northwest) dominate over the poleward alongshore pressure gradient in the Southern California Bight causing upwelling along the central California coast and south and southeastward current flows through the greater western half of the Channel. Channel waters flow south through the Channel Island passes and southeast through the eastern Channel entrance. There typically remains a remnant of a western current in the northern part of the Channel along the mainland shoreline.

There were 25 drifters successfully launched from the four launch points in the proximity of Cavern Point during the spring seasons (Table 6). Drifters tended to go southeast 36.0% of the time in the spring, with 88.9% of those drifters making shoreline contact. The second most dominant direction was north claiming 32.0% of the trajectories with a 100% shoreline contact rate. Drifters moved toward the west 24.0% of the time, with 66.6% of those drifters making contact with a beach. Drifters moved to the south or east only 4.0% of the time for each direction, but with a 100% shoreline contact rate. There were no drifters that moved northwest along the central California coast during this time period.

Final locations (Table 7) of the free floating drifters consisted of 44.0% in the Santa Barbara Channel with a 100% shoreline strike rate, 32.0% in the coastal region of the Southern California Bight with an 87.5% shoreline strike rate, and 24.0% in the western region of the Southern California Bight with a 0.0% shoreline strike rate.

**Summer Season (June – August):** The dominant flow regime during the summer season is the cyclonic flow regime. The poleward alongshore pressure gradient in the Southern California Bight and the upwelling favorable winds (from the northwest) are in balance which causes a cyclonic eddy to be formed which is at least the size of the western half of the Santa Barbara Channel.

There were 20 drifters successfully launched from the proximity of Cavern Point during the summer (Table 6). The southeast is the most dominant direction for drifter trajectory in the summer, accounting for 45.0% of the total, with 88.9% shoreline contact. The second most frequent direction for drifter movement was west, with 30.0% of drifter trajectory and a shoreline contact rate of 83.3%. Drifters advected to the south 20.0% and the east 5.0% of the time both with a 100% shoreline contact rate. No drifters moved to the north during the summer.

Final locations (Table 7) of the free floating drifters consisted of 35.0% in the Santa Barbara Channel with a 100% contact rate, 35.0% in the western region of the Southern California Bight with a 0.0% contact rate, 25.0% in the coastal region of the Southern California Bight with a 60.0% contact rate, and 5.0% in the region near the southern shorelines of the Channel Islands with a 100% contact rate. No drifters moved north to the mainland or northwest along the central California coastline during the summer seasons.

**Fall Season (September – November):** The dominant flow regimes for the fall are the relaxation and cyclonic flow regimes with reasonable representation of the upwelling flow regime. The latter two have already been described. The relaxation flow regime occurs when there is a “relaxation” of the northwest, upwelling favorable macroscopic winds allowing the poleward alongshore pressure gradient, that exists in and to the south of the Southern California Bight, to dominate. The western current flow along the mainland shoreline in the Santa Barbara Channel and the poleward current along the central California coastline reach their peak magnitudes during a full relaxation event. There typically exists an eastward flowing current of lesser magnitude along the northern shorelines of the Channel Islands.

There were 21 drifters successfully launched from the four launch points in the proximity of Cavern Point during the fall (Table 6). Drifters tended to go to the west 38.1% of the time, with 37.5% of them making contact with the shoreline. The second two most dominant directions of drifter trajectory were south and southeast with 19.5% each, with 100% of the drifters going south making contact with the shoreline and 75.0% of those moving in the southeast direction making landfall. Drifter trajectories toward the northwest along the central California coastline accounted for 14.3% of the total number of launches, with 66.7% making shoreline contact. Two drifters of the 21 launched (9.5%) during the fall season moved to the east, with both (100%) making shoreline contact. No drifters moved to the east during the fall seasons that were sampled.

Final locations (Table 7) of the free floating drifters during the fall season consisted of 42.9% in the western region of the Southern California Bight with no shoreline contact occurring, 28.6% in the Santa Barbara Channel with 83.3% making shoreline contact, 9.1% along the central California coastline with 50.0% making shoreline contact, and 9.52% in the nearshore region of the southern coastlines of the Channel Islands with 100% making landfall.

**Winter Season (December – February):** The dominant oceanic flow regimes for the winter are the relaxation flow regime, and to a slightly lesser extent, the upwelling flow regime.

There were 19 drifters successfully launched from the proximity of Cavern Point during the winter seasons (Table 6). Drifters tended to go southeast 42.1% of the time with 75.0% of those launches making shoreline contact. Drifters advected northwest along the central California coastline 31.6% of the time with 83.3% of them making shoreline contact. North was the third most prominent direction for drifter movement during the winter season at 10.5% of the drifters launched, with 100% making shoreline contact. One drifter (5.3% of the winter season launches) travels south, one travels west, and one travels east. All three made shoreline contact.

Final locations (Table 7) of the free floating drifters during the winter season consisted of 36.8% in the coastal region of the Southern California Bight with 57.1% of those drifters making shoreline contact, 31.6% along the central California coastline with 83.3% making shoreline contact, 15.8% in the Santa Barbara Channel with 100% making shoreline contact, and 10.5% in the western region of the Southern California Bight with none making landfall.

## Seasonal and Non-Seasonal Analysis Summary

It is apparent by the high shoreline contact statistics (82.4% of the 85 drifters launched from the Cavern Point area) that if an oil spill of significant size occurred at Cavern Point there would almost certainly be shoreline contact unless there was effective intervention. The drifter data represented in all of the tables, but specifically Tables 4 and 5, indicate there is virtually no particular region in the SBC-SMB area that is not vulnerable to a large spill occurring at Cavern Point. Certainly the Channel Islands and the coastal area of the Southern California Bight are the most vulnerable to oil contact with 47.1% of all drifter launches making shoreline contact in this region. The mainland coastline of the Channel suffered shoreline contact from 27.1% of all the launches from Cavern Point. Free floating drifters launched from Cavern Point reached the central California coastline at an 8.2% rate. This latter phenomenon is not represented in the MMS Pacific Region OSRA Model results.

The most important non-seasonal statistics when considering resources at risk from an oil spill are those concerning the dominant/effective direction of the drifter trajectory. Table 2 indicates that the environmental resources southeast of Cavern Point, the majority of which are outside the eastern Channel entrance, are vulnerable 35.3% of the time. Environmental resources located along the central California coastline are vulnerable 10.6% of the time from a large oil spill (over 500 barrels) occurring in the Cavern Point area. The remaining 50% of the time onshore and offshore environmental resources within the Santa Barbara Channel would be impacted by a large oil spill occurring in the Cavern Point area.

The seasonal drifter data results are consistent with the known oceanography in the SBC-SMB area. In the spring and summer seasons, the upwelling and cyclonic flow regimes, respectively, dominate the oceanic circulation in the SBC-SMB area. During these seasons, no drifters ever entered the central California coastal region which is what would be expected since no poleward current is generated during these regimes. The dominate directions during these two seasons respectively were the southeast (36.0% and 45.0%), west (24.0% and 30.0%), north (32.0% and 0.0%), and south (4.0% and 20.0%).

In the fall and winter seasons the relaxation, cyclonic, and upwelling flow regimes, in that order, dominate the oceanic circulation in the SBC-SMB area. The dominant directions for the drifters launched during the fall seasons are west (38.1%), southeast (19.1%), south (19.1%), northwest (14.3%), and north (9.5%). Unlike the spring and summer seasons, in the fall a significant number of drifter trajectories travel northwest along the central California coast.

The dominant directions for the drifters launched during the winter seasons are the southeast (42.1%), northwest along the central California coast (31.6%), north (10.5%), south (5.3%), west (5.3%), and east (5.3%). In the winter a third of the drifter trajectories travel northwest along the central California coast.

In summary, what are the areas most vulnerable to an oil spill occurring at Cavern Point, and by what degree? Table 4 indicates that 61.2% of all drifter strikes launched from the Cavern Point area occur within the SBC. From the Cavern Point area it takes from less than a day to up to 4 days to strike anywhere in the Channel. The remaining 38.8% of drifter strikes occur southeast of the SBC at the Southern California Bight shorelines, or at Pt. Arguello and north along the southern central California coastline. While it is possible that oil could hit the regions beyond the SBC, it would have to be unabated by organized response measures and weathering. The regions southeast of the SBC are the next most vulnerable since the southeast is a high percentage dominant direction with shoreline availability for drifters during all 4 seasons. It would take 5 to 10 days for a spill travelling southeast out of the eastern Channel entrance to strike Redondo Beach.

Drifters, and therefore oil, are only carried in the direction along the central California coastline during a relaxation event, which typically occurs during the fall and winter seasons. Drifter data also indicates that it would take 5 to 20 days for oil spilling from the Cavern Point area to make landfall somewhere along the central California coastline. So, while it is significant that 11.8% of all drifters launched from the Cavern Point area make their final location along the central California coastline, it would require a catastrophic event at Cavern Point to jeopardize resources in the shoreline areas north of Pt. Arguello.

## PLATFORM HILLHOUSE GNOME AND OSRA ANALYSES.

During the relaxation flow regime the composite analysis indicates that trajectories are primarily directed to the west along the northern shoreline of the SBC and out its western entrance where the majority turn the corner at Point Arguello and continue north along the central California coast. Other trajectories will frequently continue west, but some will go southwest toward the equator, or southeast toward the western Channel Islands.

During the convergent flow regime the composite analysis indicates that the trajectories initially travel west along the mainland shoreline but then the majority turn south to southeast inside the western portion of the channel toward the San Miguel and Santa Rosa Islands. Some trajectory is directed out the southwestern corner of the western SBC entrance.

During the upwelling flow regime the composite analysis indicates that the trajectories, as in the convergent case, initially travel west but then turn to the south and southeast sooner than during a convergent flow regime. Trajectories continue south to southeast toward the eastern-most Channel islands: Santa Catalina and Anacapa Islands and out the eastern entrance of the SBC to continue into the Southern California Bight.

### GNOME Analysis for a 200 bbl Oil Spill

The GNOME analysis results for a spill at Platform Hillhouse are summarized here. Only one wind excursion (0 mps) was used for the 3-day Hillhouse run because of the significant decrease in wind stress in the northeastern section of the SBC compared to the location of the wind measurements at NDBC 54 in the western SBC entrance.

The 3-day Relaxation flow regime excursion indicates that 71 bbl of oil would beach at Santa Barbara, Goleta Pt., and Gaviota. Additionally, 79 bbl of oil will weather, 50 bbl of oil will continue to float, and 0 bbl will travel off the model domain. For all three wind scenarios for the 10-day Relaxation flow regime excursion 19-52 bbl will beach at Goleta Pt., Gaviota, and Pt. Arguello to Purisima Pt. to Pt. Sal. Additionally, 97 bbl of oil will weather, 44-83 bbl of oil will continue to float and 0-7 bbl oil will continue to move north in the SMB and out of the model domain.

The 3-day Convergent flow regime excursion indicates that 24 bbl of oil will beach at Goleta Pt. and Gaviota. Additionally, 79 bbl of oil will weather, 97 bbl of oil will continue to float, and 0 bbl will travel of the map domain. The 10-day Convergent flow scenario indicates that 20 bbl of oil will beach on San Miguel and Santa Rosa Islands and on Capitan on the SBC mainland. Additionally, 97 bbl of oil will weather, 30 bbl of oil will continue to float, and 53 bbl of oil will travel south, offshore of the western SBC entrance into the SCB and out of the model domain.

The 3-day Upwelling flow regime excursion indicates that 16 bbl of oil will beach at Santa Barbara and Gaviota. Additionally, 79 bbl of oil will weather, 105 bbl of oil will continue to float, and 0 bbl of oil will travel off the model domain. The 10-day Upwelling flow scenario indicates that 8 bbl of oil will beach at Santa Cruz and Santa Rosa Islands, 97 bbl of oil will weather, 15 bbl of oil will continue to float, and 80 bbl of oil will travel southeast out of the eastern SBC entrance.

### GNOME Analysis for a 2000 bbl Oil Spill

The GNOME analysis results for a spill at Platform Hillhouse are summarized here. Only one wind excursion (0 mps) was used for the 3-day Hillhouse run because of the significant decrease in wind stress in the northeastern section of the SBC compared to the location of the wind measurements at NDBC 54 in the western SBC entrance.

The 3-day Relaxation flow regime excursion indicates that 698 bbl of oil will beach at Santa Barbara, Goleta Pt., and Gaviota. Additionally, 794 bbl of oil will weather, 508 bbl of oil will continue to float, and 0 bbl will travel off the model domain. For all three wind scenarios for the 10-day Relaxation flow regime excursion 164-570 bbl will beach at Santa Barbara, Goleta Pt., Gaviota, Pt. Conception, and Pt. Arguello to Purisima Pt. to Pt. Sal. Additionally, 972-974 bbl of oil will weather, 404-864 bbl of oil will continue to float, and 0-54 bbl oil will continue to move north in the SMB and out of the model domain.

The 3-day Convergent flow regime excursion indicates that 240 bbl of oil will beach at Goleta Pt. and Gaviota. Additionally, 794 bbl of oil will weather, 966 bbl of oil will continue to float, and 0 bbl will travel off the model domain. The 10-day Convergent flow scenario indicates that 202 bbl of oil will beach on San Miguel and Santa Rosa Islands and on Capitan on the SBC mainland. Additionally, 966 bbl of oil will weather, 302 bbl of oil will continue to float, and 530 bbl of oil will travel south, offshore of the western SBC entrance into the SCB and out of the model domain.

The 3-day Upwelling flow regime excursion indicates that 156 bbl of oil will beach at Santa Barbara and Gaviota. Additionally, 794 bbl of oil will weather, 1050 bbl of oil will continue to float, and 0 bbl of oil will travel off the model domain. The 10-day Upwelling flow scenario indicates that 84 bbl of oil will beach at Santa Cruz and Santa Rosa Islands, 970 bbl of oil will weather, 150 bbl of oil will continue to float, and 796 bbl of oil will travel southeast out of the eastern SBC entrance.

### OSRA Model Analysis

The winter 3-day OSRA Model run for Platform Hillhouse indicates a 1 percent probability that an oil spill will contact Santa Barbara and a 5 percent chance of contacting Coal Oil Point. The winter 10-day run indicates a 1 to 3 percent probability of contact between Ventura and Santa Barbara, and a 1 to 2 percent probability of shoreline contact at Coal Oil Pt. to Pt. Arguello. There is also a 5 percent chance that an oil spill will contact San Miguel Island and a 2 to 3 percent probability of shoreline contact at Santa Cruz Island during a 10-day oil spill event.

The spring 3-day run indicates a 1 percent probability of an oil spill contact with Oxnard and Ventura, a 3 percent probability of landfall at Santa Barbara and a 2 percent chance of landfall at Coal Oil Point. The spring 10-day run indicates a 14 percent chance of oil spill landfall at Port Hueneme and a 2 to 4 percent chance of landfall occurring at Santa Barbara and Coal Oil Point.

The summer 3-day run indicates a 3 percent probability of an oil spill contact at Santa Barbara. The summer 10-day run indicates a 4 percent probability of landfall near Pt. Dume, a 14 to 24 percent probability of an oil spill contact with Port Hueneme, and a 3 percent chance of an oil spill landfall at Santa Barbara.

The fall 3-day run indicates a 1 to 6 percent probability of an oil spill making landfall between Santa Barbara and Coal Oil Point. The fall 10-day run indicates a 1 to 16 percent probability of an oil spill landfall occurring in the Santa Barbara to Coal Oil Pt. area, and a 2 to 5 percent chance of oil spill landfall between Coal Oil Pt. and Pt. Conception. Additionally, this 10-day run for the fall season indicates that there is a 1 to 2 percent probability that landfall will occur between Anacapa and Santa Cruz Islands and a 5 to 9 percent chance that oil spill landfall could occur between Santa Rosa and San Miguel Islands.

## SANTA CLARA UNIT (PLATFORM GAIL) GNOME AND OSRA ANALYSES.

Examples of GNOME Model output for 2000 bbl spills during for all 3 flow regimes at platform Gail are illustrated in appendix figures 5.2-15 through 5.2-18. Examples of OSRA Model output in GIS format for a hypothetical oil spill during each of the 4 seasons at Platform Gail is presented in appendix figures 5.2-19 through 5.2-22. Examples of drifter plots for each of the three flow regimes can be found in appendix figures 5.2-23a and b, 5.2-24a and b, and 5.2-25a and b.

During the relaxation flow regime the composite analysis indicates that trajectories are primarily directed to the west along the northern shoreline of the SBC and out its western entrance where the majority turn the corner at Point Arguello and continue north along the central California coast. Other trajectories will frequently continue west, but some will go southwest toward the equator, or southeast toward the western Channel Islands. Some trajectories head north toward the Gaviota-Capitan portion of the SBC mainland or southwest toward the western-most Channel Islands: San Miguel and Santa Rosa.

During the Convergent flow regime the composite analysis indicates that trajectories initially either go northwest towards the Carpenteria to Ventura portion of the SBC mainland with the majority of trajectories changing course to directly west along the SBC mainland. They then proceed to turn south to southeast, along with the western cyclonic gyre, toward the San Miguel, Santa Rosa, and Santa Cruz Islands and their Island passes.

During the Upwelling flow regime the composite analysis indicates that almost 100 percent of the trajectories are directed southeast out of the eastern SBC entrance and into the Southern California Bight.

### GNOME Analysis for a 200 bbl Oil Spill

The GNOME launch point for the Santa Clara Unit is the location of Platform Gail. The GNOME analysis results for a spill at Platform Gail are summarized here. Only one wind scenario (0 mps) was used for the 3-day, Relaxation event, Gail run because of the significant decrease in wind stress in the eastern and northeastern section of the SBC compared to the location of the wind measurements at NDBC 54 in the western SBC entrance.

The 3-day Relaxation flow regime scenario indicates that 21 bbl of oil will beach at Santa Barbara and Gaviota. Additionally, 79 bbl of oil will weather, 99 bbl of oil will continue to float, and 0 bbl will travel off the model domain. For all three wind scenarios for the 10-day Relaxation flow scenario 8-37 bbl will beach at Goleta Pt., Gaviota, Naples, Pt. Arguello to

Pt. Sal, Pt. Sa Luis, and San Miguel and Santa Rosa Islands. Additionally, 97 bbl of oil will weather, 48-93 bbl of oil will continue to float, and 1-18 bbl of oil will continue to move north in the SMB or south offshore the western SBC entrance to the SCB and out of the model domain.

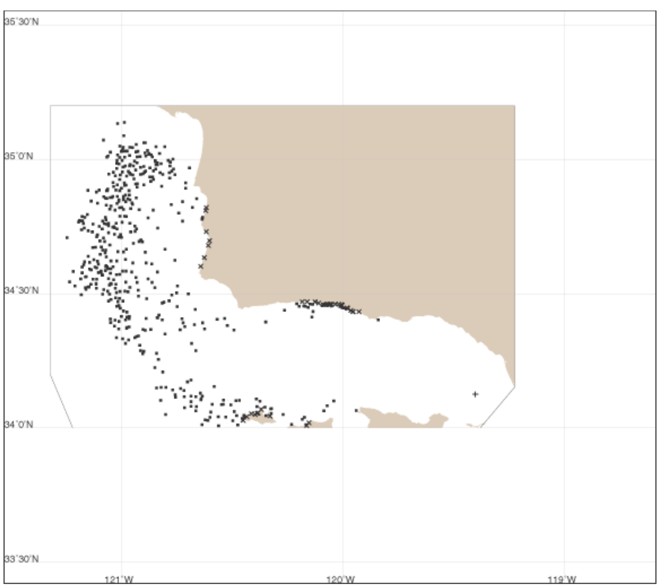
The 3-day Convergent flow regime scenario indicates that 19 bbl of oil will beach at Carpenteria, Santa Barbara, Gaviota, and Ventura. Additionally, 79 bbl of oil will weather, 101 bbl of oil will continue to float, and 0 bbl will travel off the model domain. The 10-day Convergent flow scenario indicates that 42 bbl of oil will beach on San Miguel, Santa Rosa, and Santa Cruz Islands, and at Carpenteria on the SBC mainland. Additionally, 96 bbl of oil will weather, 37 bbl of oil will continue to float, and 26 bbl of oil will travel south, offshore of the western SBC entrance into the SCB and out of the model domain.

The 3-day and 10-day Upwelling flow regime scenarios give the same results: 0 bbl of oil will beach, 15 bbl of oil will weather, 0 bbl of oil will continue to float, and 185 bbl of oil will travel southeast out of the eastern SBC entrance into the SCB and off the model domain. A 7 hour Upwelling flow scenario indicates that 0 bbl of oil will beach, 15 bbl of oil will weather, 16 bbl of oil will continue to float, and 169 bbl of oil will travel southeast out of the eastern SBC entrance into the SCB and out of the model domain.

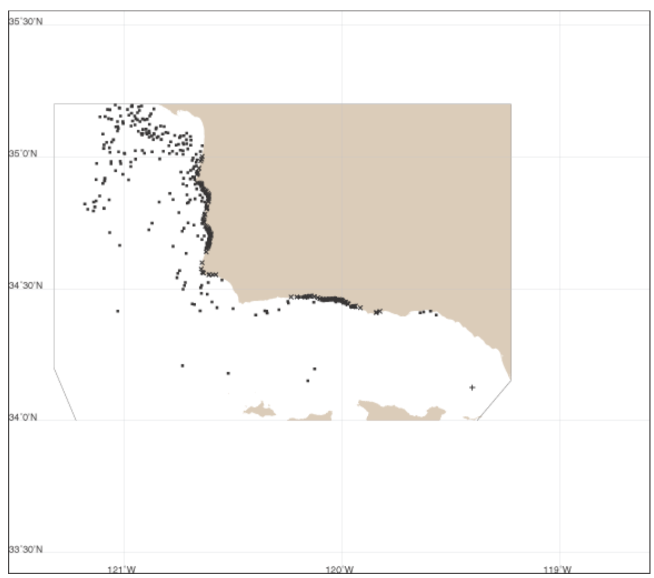
**GNOME Analysis for a 2000 bbl Oil Spill**

The GNOME launch point for the Santa Clara Unit is the location of Platform Gail. The GNOME analysis results for a spill at Platform Gail are summarized here. Only one wind scenario (0 mps) was used for the 3-day, Relaxation event, Gail run because of the significant decrease in wind stress in the eastern and northeastern section of the SBC compared to the location of the wind measurements at NDBC 54 in the western SBC entrance.

The 3-day Relaxation flow regime scenario indicates that 212 bbl of oil will beach at Santa Barbara and Gaviota. Additionally, 794 bbl of oil will weather, 994 bbl of oil will continue to float, and 0 bbl will travel off the model domain. For all three wind scenarios for the 10-day Relaxation flow scenario 82-368 bbl will beach at Goleta Pt., Gaviota, Naples, Pt. Arguello to Pt. Sal, Pt. Sa Luis, and San Miguel and Santa Rosa Islands. Additionally, 970-974 bbl of oil will weather,



***Appendix Figure 5.2-15. GNOME Modeled 10 day, 2000 bbl oil spill scenario for platform Gail (depicted by "+"), located in the center of the Channel near its eastern entrance, during a relaxation flow regime and a 4 m/s NW wind. GNOME model output indicates that of 2000 bbl released: 94 bbl beach, 974 bbl evaporate or are dispersed, 924 bbl are still floating, and 8 bbl have moved out of the model domain heading west out of the Santa Maria Basin and south to southeast offshore of the Southern California Bight.***



***Appendix Figure 5.2-16. GNOME Modeled 10 day, 2000 bbl oil spill scenario for platform Gail (depicted by "+"), located in the center of the Channel near its eastern entrance, during a relaxation flow regime and a 4 m/s SW wind. GNOME model output indicates that of 2000 bbl released: 316 bbl beach, 978 bbl evaporate or are dispersed, 534 bbl are still floating, and 172 bbl have moved out of the model domain heading north out of the Santa Maria Basin.***