Refugio Beach Oil Spill Incident Fisheries Closure Chemical Testing Results Summary

Office of Environmental Health Hazard Assessment
California Environmental Protection Agency
July 2015

On May 19, 2015, following the Refugio Beach oil spill incident in Santa Barbara County, the California Department of Fish and Wildlife (CDFW) implemented a fisheries closure as recommended by the Office of Environmental Health Hazard Assessment (OEHHA). The closure area was expanded significantly on May 21, based on aerial observations and National Oceanic and Atmospheric Administration (NOAA) oil spill trajectory models of where the oil was likely to move. Based on the health evaluation described below, OEHHA recommended on June 29, 2015 that CDFW rescind the fishery closure order.

California Department of Fish and Wildlife Commercial Fishing Blocks

Commercial fishing areas are designated geographically as "California Department of Fish and Wildlife Commercial Fishing Blocks" ("blocks" in this report). Blocks consist of approximately 10 x 10 nautical mile areas that commercial fishermen use to report the location of their catch. The vast majority of the fishery closure area was encompassed by blocks 654 (the eastern portion of the closure area), 655 (the central portion of the closure area, including the Refugio Beach area), and 656 (the western portion of the closure area). Within each of these blocks, smaller, centrally-located "sampling blocks" were identified to target sampling efforts. The goal was to be able to make fishery re-opening decisions on a block-by-block basis. The fisheries closure area, fishing blocks, and sampling blocks are shown in Figure 1.

Marine Species Sampling

CDFW and OEHHA jointly developed a sampling and analysis plan to assess concentrations of oil spill-related chemicals in seafood from the impacted area. Species were selected for sampling based on three factors: 1) potential for exposure to oil, 2) recreational or commercial importance, and 3) representation of different feeding ecologies and habitat types within the closure zone.

Bivalve mollusks, such as mussels, were sampled because they cannot move away from the oil and also cannot remove oil chemicals from their bodies easily or quickly. As a result, they pose a greater likelihood of accumulating specific oil-spill-related chemicals of human health concern. Bivalve mollusks are often used as an indicator of the level and trends of contamination in aquatic life for a variety of pollutants.

Finfish, other invertebrate species, and kelp were also collected and analyzed. Given the estimated volume of the spill and the large geographic area and number of species potentially impacted, it was important to more fully characterize the degree of contamination in a variety of species and include offshore as well as onshore locations.

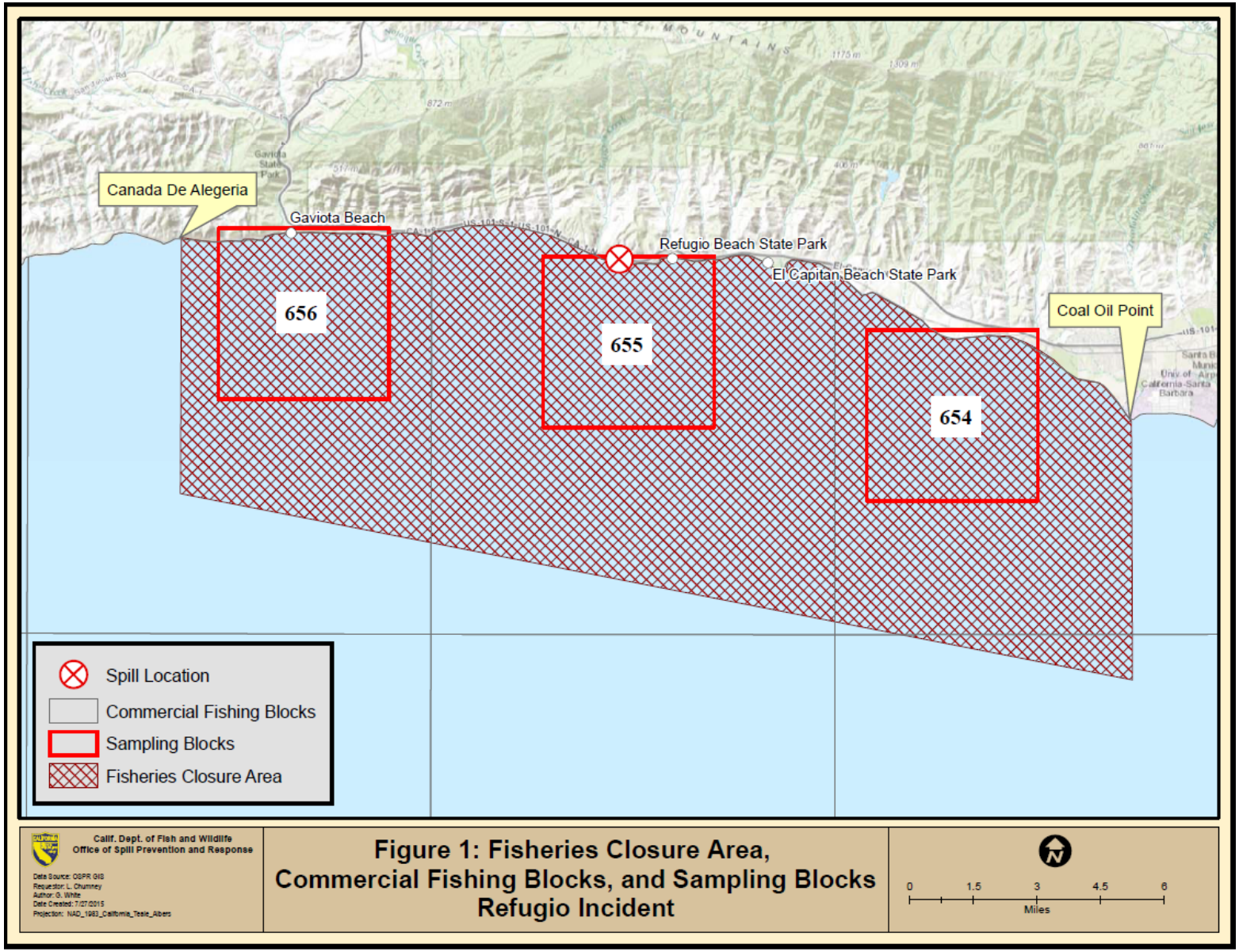
Finfish and invertebrates other than mussels and abalone were collected and analyzed from each of the blocks over a 10 day period approximately three to four weeks after the spill to represent the entire closure area. The locations of species collected from each block are shown in Figures 2, 3, and 4 for blocks 654, 655, and 656, respectively. In total, the number of finfish and (non-mussel) invertebrate samples collected and analyzed from blocks 654, 655, and 656 were 106, 150, and 105, respectively. Thirty-six samples of kelp were also collected, including nine from each of the blocks and nine from a reference area west of the closure area (Figure 5). Additionally, a total of 341 mussels were collected and analyzed from numerous sites along the affected shoreline during sampling events over a 26 day period (Figure 6). A total of 18 red abalone were collected and analyzed on two occasions from an onshore abalone farm that uses water from the closure area (nine per occasion) (Figure 6).

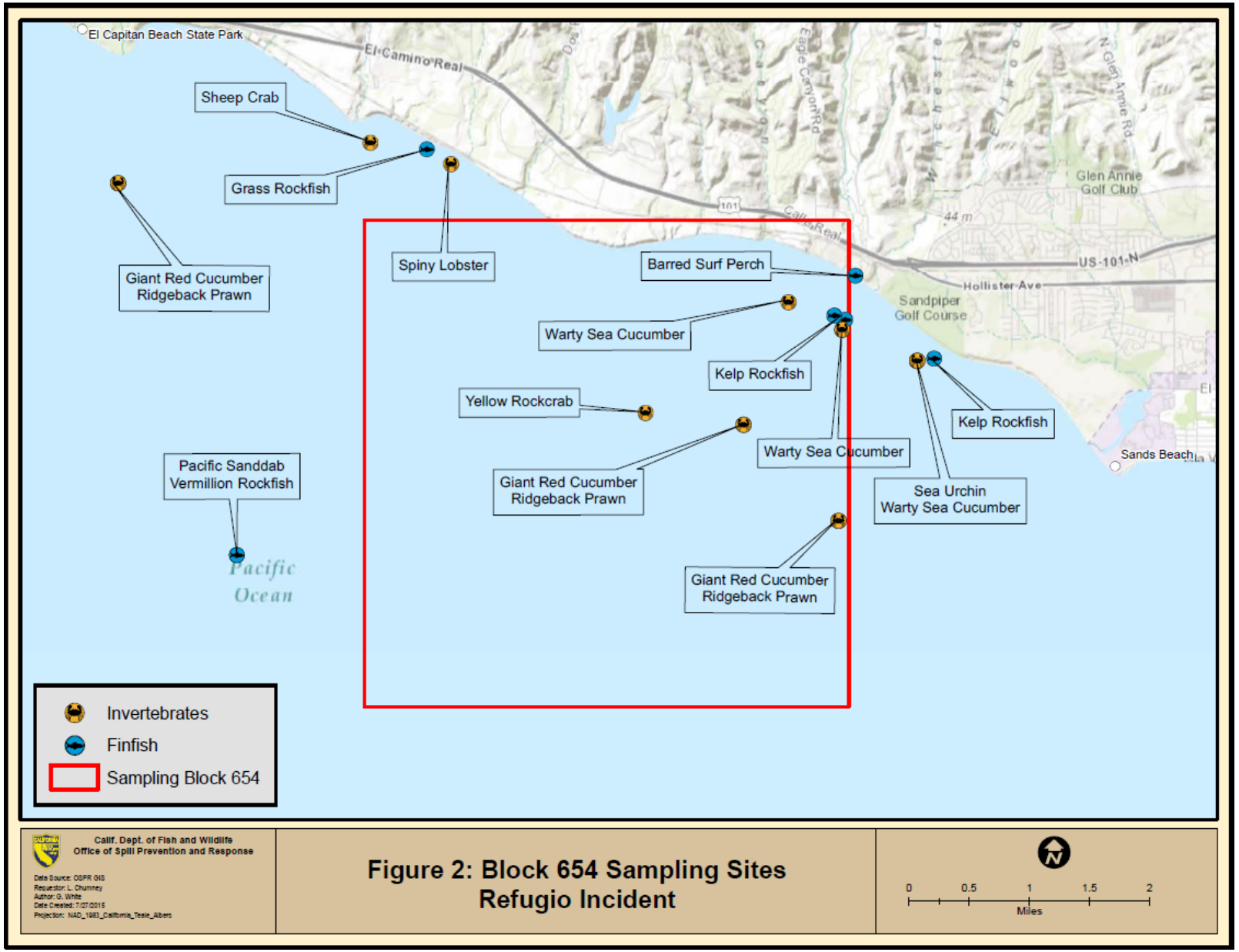
Chemical Analysis and Health Evaluation

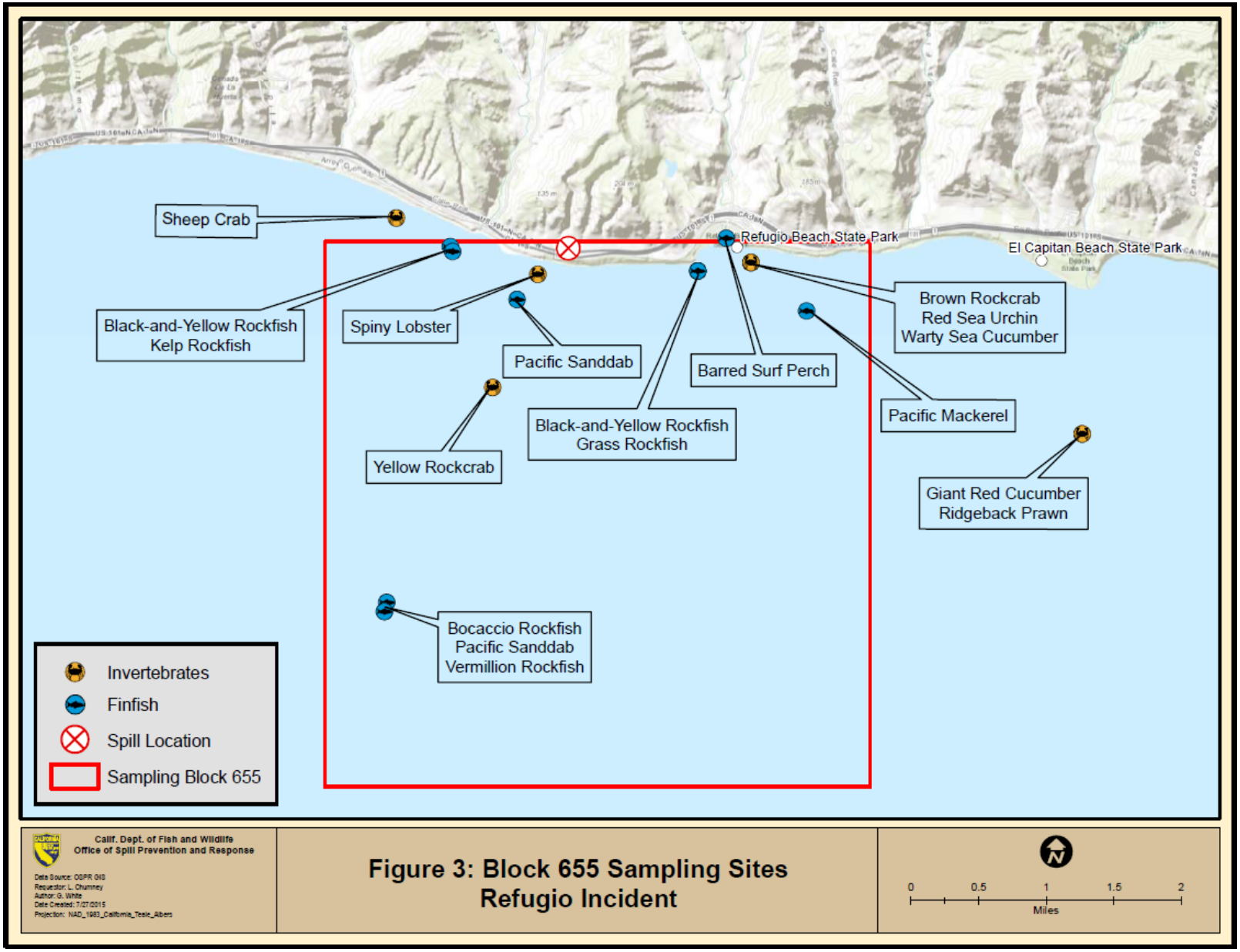
All samples were analyzed for polycyclic aromatic hydrocarbons (PAHs). PAHs are the chemicals in petroleum products most likely to accumulate in seafood and pose the greatest potential health risk to people who eat oil-contaminated seafood. Cancer is considered the most sensitive adverse health effect (i.e., that occurs at the lowest dose) and only certain PAHs are considered to cause cancer. (See this fact sheet for more information: http://oehha.ca.gov/fish/pdf/OilSpillsSeafoodFacts2015.pdf.) In order to evaluate the cancer risk posed by these chemicals, concentrations of carcinogenic PAHs were converted into benzo[a]pyrene equivalent concentrations (BaPE) and summed to give ∑BaPE concentration. (See OEHHA's protocol for seafood risk assessment at: http://oehha.ca.gov/fish/pdf/2015UpdateSeafoodOilspills.pdf.) In the above-mentioned protocol, OEHHA determined a Level of Concern (LOC) of 27 parts per billion (ppb) (wet weight) for ∑BaPE concentration. Samples with less than 27 ppb (wet weight) ∑BaPE are considered safe to consume with respect to oil spill-related chemicals. The public should continue to follow state advisories or quarantines regarding other health concerns in seafood species, such as the annual quarantine of sport-harvested mussels, which began May 1, to protect the public from paralytic shellfish poisoning and domoic acid poisoning.

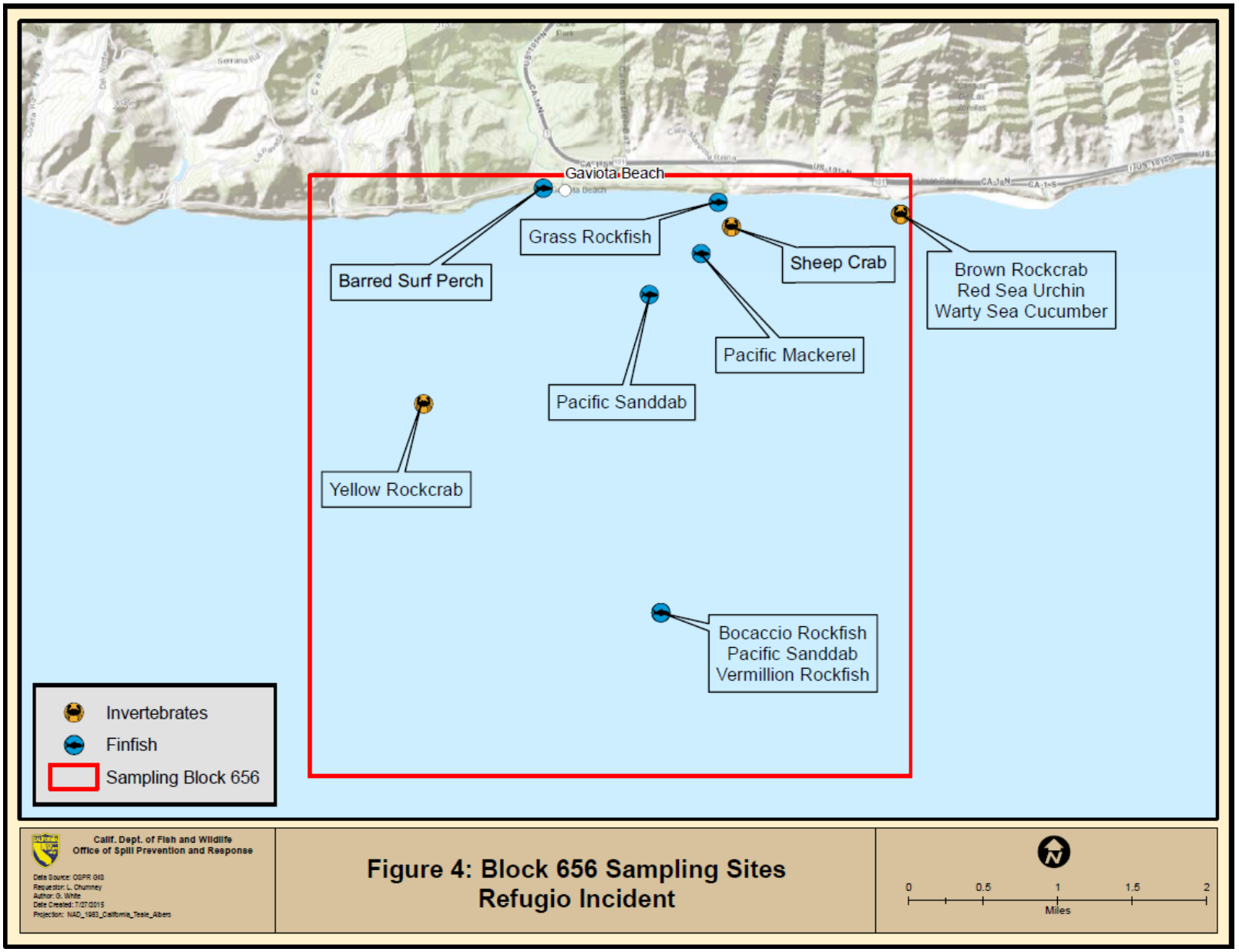
∑BaPE concentrations in collected species are provided in Table 1 and Figure 7. Finfish and crustaceans had very low or non-detectable levels of ∑BaPE throughout the closure area. Red sea urchins and warty sea cucumbers had somewhat elevated levels of ∑BaPE in block 655 (nearest Refugio Beach) (13.6 and 6.9 ppb ∑BaPE, respectively). Red sea urchins had slightly elevated ∑BaPE levels in blocks 655 and 654 (5.7 and 2.5 ppb, respectively). ∑BaPE concentrations in all kelp samples were very low (0.2 to 0.3 ppb). Abalone had very low ∑BaPE concentrations in the first sampling event (June 5) and non-detectable concentrations in the second sampling

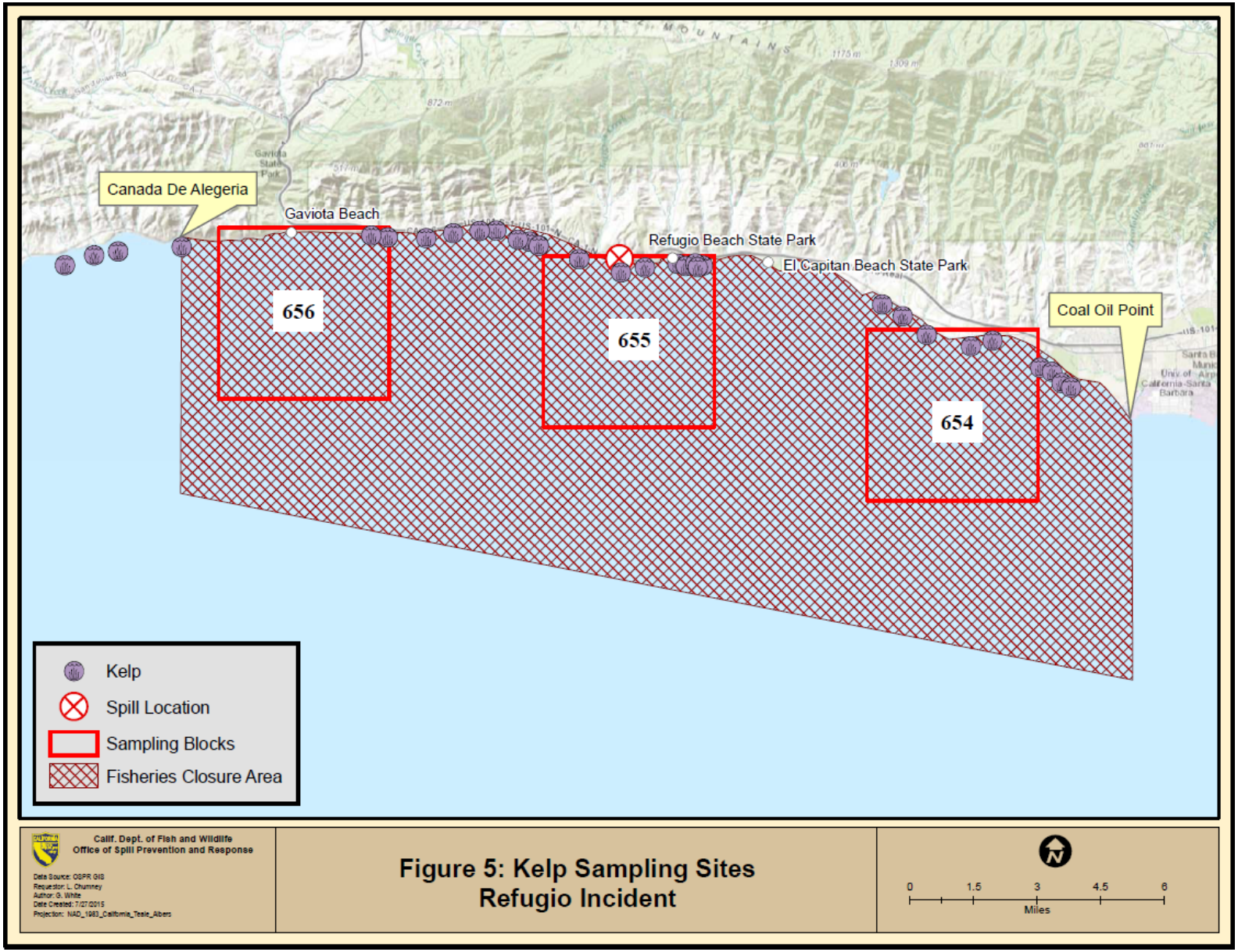
event (June 18). Among the sites where mussels were collected and analyzed, mussels initially (May 24) had very high levels at Refugio Beach, El Capitan Beach, and Haskell's Beach (264.3, 180.1, and 101.6 ppb ∑BaPE, respectively). However, by the last mussel sampling period (June 17th and 18th), all mussels samples had fallen below the LOC.


Canada De Alegeria
Gaviota Beach
Refugio Beach State Park
El Capitan Beach State Park
Coal Oil Point
656
655
654
Spill Location
Commercial Fishing Blocks
Sampling Blocks
Fisheries Closure Area
Calif. Dept. of Fish and Wildlife
Office of Spill Prevention and Response
Figure 1: Fisheries Closure Area,
Commercial Fishing Blocks, and Sampling Blocks
Refugio Incident
0
1.5
3
4.5
6
Miles


El Capitan Beach State Park
El Camino Real
Sheep Crab
Grass Rockfish
Giant Red Cucumber
Ridgeback Prawn
Spiny Lobster
Barred Surf Perch
Warty Sea Cucumber
Kelp Rockfish
Yellow Rockcrab
Pacific Sanddab
Vermillion Rockfish
Giant Red Cucumber
Ridgeback Prawn
Warty Sea Cucumber
Kelp Rockfish
Sea Urchin
Warty Sea Cucumber
Giant Red Cucumber
Ridgeback Prawn
Pacific
Ocean
Glen Annie
Golf Club
US-101-N
Hollister Ave
Sandpiper
Golf Course
Sands Beach
Invertebrates
Finfish
Sampling Block 654
Calif. Dept. of Fish and Wildlife
Office of Spill Prevention and Response
Figure 2: Block 654 Sampling Sites
Refugio Incident
0
0.5
1
1.5
2
Miles


Sheep Crab
Refugio Beach State Park
El Capitan Beach State Park
Black-and-Yellow Rockfish
Kelp Rockfish
Spiny Lobster
Pacific Sanddab
Barred Surf Perch
Brown Rockcrab
Red Sea Urchin
Warty Sea Cucumber
Pacific Mackerel
Black-and-Yellow Rockfish
Grass Rockfish
Yellow Rockcrab
Giant Red Cucumber
Ridgeback Prawn
Bocaccio Rockfish
Pacific Sanddab
Vermillion Rockfish
Invertebrates
Finfish
Spill Location
Sampling Block 655
Calif. Dept. of Fish and Wildlife
Office of Spill Prevention and Response
Figure 3: Block 655 Sampling Sites
Refugio Incident
0
0.5
1
1.5
2
Miles


Gaviota Beach
Barred Surf Perch
Grass Rockfish
Sheep Crab
Brown Rockcrab
Red Sea Urchin
Warty Sea Cucumber
Pacific Mackerel
Pacific Sanddab
Yellow Rockcrab
Bocaccio Rockfish
Pacific Sanddab
Vermillion Rockfish
Invertebrates
Finfish
Sampling Block 656
Calif. Dept. of Fish and Wildlife
Office of Spill Prevention and Response
Data Source: OSPR GIS
Requestor: L. Chumney
Author: G. White
Date Created: 7/27/2015
Projection: NAD_1983_California_Teale_Albers
Figure 4: Block 656 Sampling Sites
Refugio Incident
0
0.5
1
1.5
2
Miles


Canada De Alegeria
Gaviota Beach
Refugio Beach State Park
El Capitan Beach State Park
Coal Oil Point
656
655
654
Kelp
Spill Location
Sampling Blocks
Fisheries Closure Area
Calif. Dept. of Fish and Wildlife
Office of Spill Prevention and Response
Figure 5: Kelp Sampling Sites
Refugio Incident
0
1.5
3
4.5
6
Miles

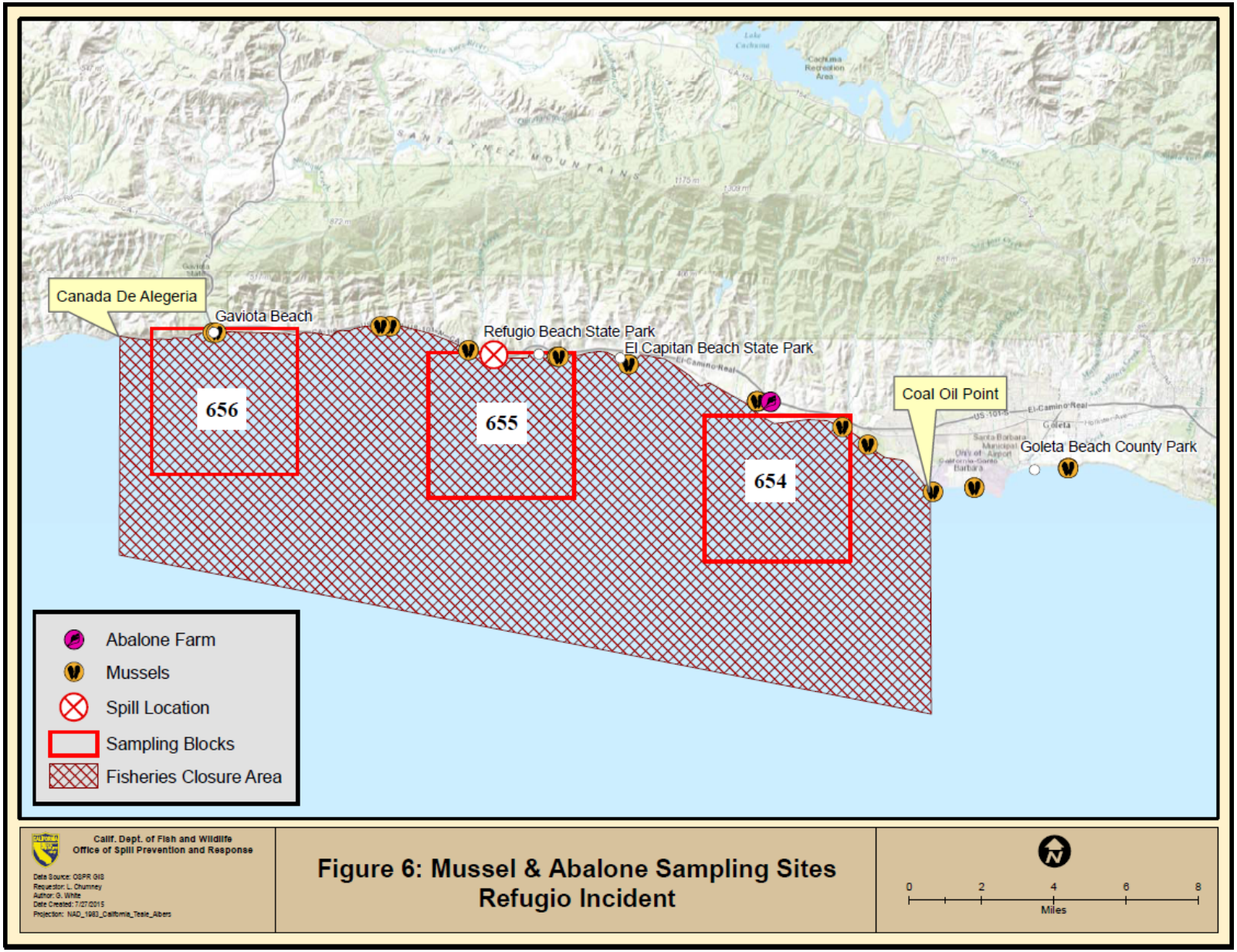

Canada De Alegeria
Gaviota Beach
Refugio Beach State Park
El Capitan Beach State Park
Coal Oil Point
Goleta Beach County Park
656
655
654
Abalone Farm
Mussels
Spill Location
Sampling Blocks
Fisheries Closure Area
Calif. Dept. of Fish and Wildlife
Office of Spill Prevention and Response
Figure 6: Mussel & Abalone Sampling Sites
Refugio Incident
0 2 4 6 8
Miles

Table 1. ∑BaPE Concentrations in Finfish, Invertebrates, and Kelp Collected in Response to the Refugio Beach Oil Spill Incident

Sample Location	Date Collected	Species	Number of Individuals/ Composite*	∑BaPE ng/g or ppb (wet weight)**
Block 654	6/10	Barred Surf Perch (*Hyperprosopon ellipticum)*	9	0
	6/10	Kelp Rockfish (*Sebastes atrovirens)*	9	0
	6/10	Pacific Sand dab (deeper water) (*Citharichthys sordidus)*	9	0
	6/10	Red Sea Urchin (*Strongylocentrotus franciscanus)*	9	2.5
	6/10	Vermillion Rockfish (*Sebastes miniatus)*	8	0
	6/10	Warty Sea Cucumber (*Apostichopus parvimensis*)	9	1.0
	6/12	Giant Red Cucumber (*Apostichopus californicus)*	8	1.0
	6/12	Grass Rockfish (*Sebastes rastrelliger*)	11	0.1
	6/12	Ridgeback Prawn (*Sicyonia ingentis*)	12	0
	6/15	Yellow Rock Crab(*Cancer anthonyi*)	10	ND
	6/15	California Spiny Lobster (*Panulirus interruptus)*	3	0.7
	6/18	Sheep Crab (*Loxorhynchus grandis)*	9	0.2
	6/19	Giant Kelp (*Macrosystis pyrifera)*	9	0.2
Block 655	6/10	Barred Surf Perch (*Hyperprosopon ellipticum)*	4	0.1
	6/11	Black & Yellow Rockfish (*Sebastes chrysomelas)*	7	0.1
	6/11	Bocaccio Rockfish (*Sebastes paucispinis*)	9	0
	6/11	Brown Rock Crab (*Cancer antennarius)*	6	0.2
	6/11	Grass Rockfish	13	0
	6/11	Kelp Rockfish	9	0.1
	6/11	Red Sea Urchin	9	13.6
	6/11	Pacific Sanddab (deeper water)	11	0
	6/11	Vermillion Rockfish	9	0
	6/11	Warty Sea Cucumber	9	6.9
	6/12	Giant Red Cucumber	12	0.9
	6/12	Ridgeback Prawn	11	0.1
	6/15	Yellow Rock Crab	10	ND
	6/15	California Spiny Lobster	1	0.5
	6/18	Sheep Crab	9	1.3
	6/19	Pacific Sanddab (shallower water)	10	0
	6/19	Giant Kelp	9	0.3
	6/19	Pacific Mackerel (*Trachurus symmetricus)*	10	0.6

Sample Location	Date Collected	Species	Number of Individuals/ Composite	∑BaPE ng/g or ppb (wet weight)*
Block 656	6/10	Barred Surf Perch	9	0
	6/11	Brown Rock Crab	6	0.1
	6/11	Red Sea Urchin	9	5.7
	6/11	Warty Sea Cucumber	10	0.8
	6/12	Bocaccio Rockfish	9	0.1
	6/12	Grass Rockfish	7	0.1
	6/12	Pacific Sanddab (deeper water)	12	0
	6/12	Vermillion Rockfish	9	ND
	6/15	Yellow Rock Crab	10	ND
	6/18	Sheep Crab	6	0.2
	6/19	Pacific Mackerel	9	0.3
	6/19	Giant Kelp	9	0.3
	6/19	Pacific Sanddab (shallower water)	9	0
Drake's Bay	6/19	Giant Kelp	9	0.3

*One composite was analyzed per species per block, when available

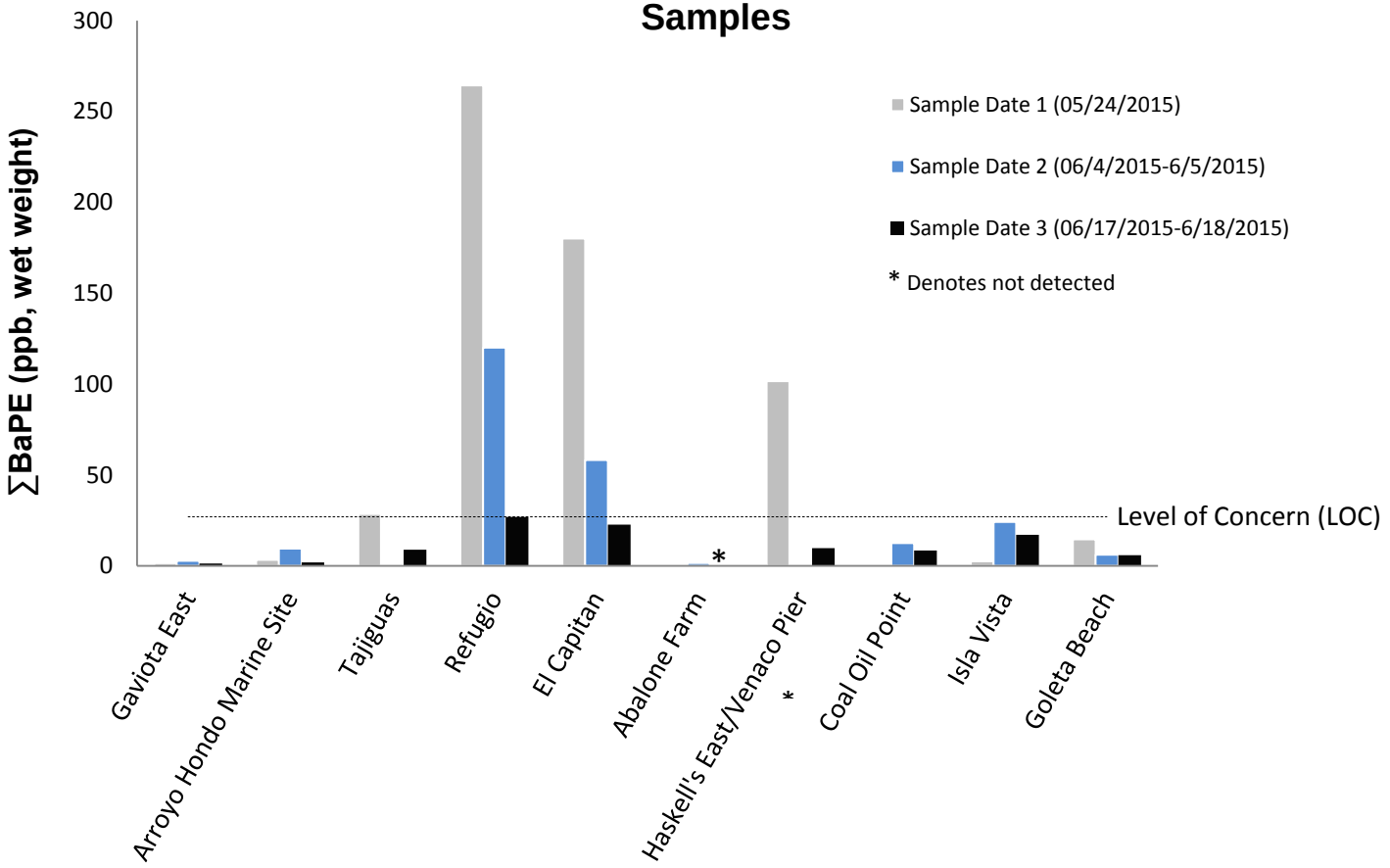
** ∑BaPE = the sum of benzo[a]pyrene equivalents, a measure of the ability of oil-related chemicals to cause cancer. OEHHA's "Level of Concern" (LOC) for ∑BaPE is 27 ng/g or ppb (wet weight). ∑BaPE concentrations below 27 ng/g are considered safe.

ND = concentrations for all carcinogenic PAHs were below detection limits.

In calculating BaPE for individual carcinogenic PAHs, PAH concentrations less than 5 times the concentration in the method blank were censored.

0 = concentrations for ∑BaPE were <0.05.

Figure 7. Refugio Beach Oil Spill Incident Mussel & Abalone Samples



(Except for the abalone farm, all results on this graph are for mussels)