



Water



Passive Sampling



Passive Sampling

- **Sampling Locations (17 total):**

- original 9 stations,
- 1 reference station, and
- 7 new stations

- **Material:**

- Solid Phase Microextraction (SPME) fibers,
- Polyethylene (C^{13} labeled 4,4'-DDT, 4,4'-DDE, 4,4'-DDD, and four C^{13} -labeled PCB congeners)

- **Depths:**

- 5 meters above ocean floor, mid-column, and 5 meters below ocean surface.



Passive Sampling (cont.)

- **Conducted By:**

- Dr. Loretta Fernandez, Fluent Point

- **Deployment:**

- September 5, 2013 – September 6, 2013
- Deployed by Sanitation Districts using the *Ocean Sentinel*

- **Retrieval:**

- October 8, 2013 – October 9, 2013
- Retrieved by Sanitation Districts using the *Ocean Sentinel*

- **Analytical Laboratory:**

- Southern California Coastal Water Research Program Laboratory



Passive Sampling Analytes

- **DDT Compounds:**

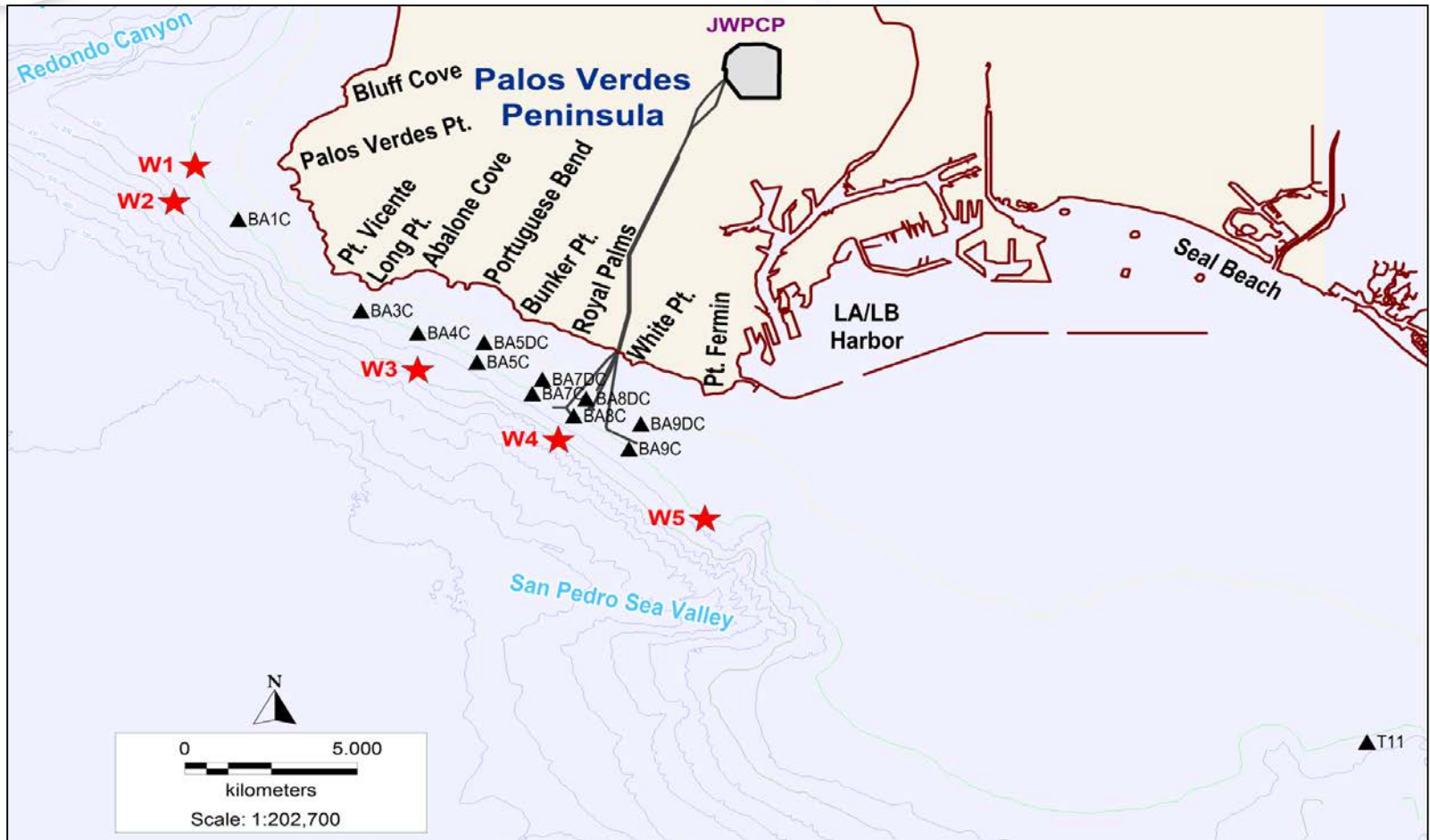
- p,p'-DDE, o,p'-DDE, p,p'-DDD, o,p'-DDD, p,p'-DDMU, p,p'-DDNU,

- **PCBs Expanded List (46 Congeners):**

- PCB 8,18, 28, 37, 44, 49, 52, 66, 70, 74, 77, 81, 87, 99, 101, 105, 110, 114, 118, 119, 123, 126, 128, 138, 149, 151, 153/168, 156, 157, 158, 167, 169, 170, 177, 180, 183, 187, 189, 194, 200, 201, 206, 209



Passive Sampling Locations



Black triangles indicate stations sampled in both 2010 and 2013.
Red stars are stations added for the 2013 study.

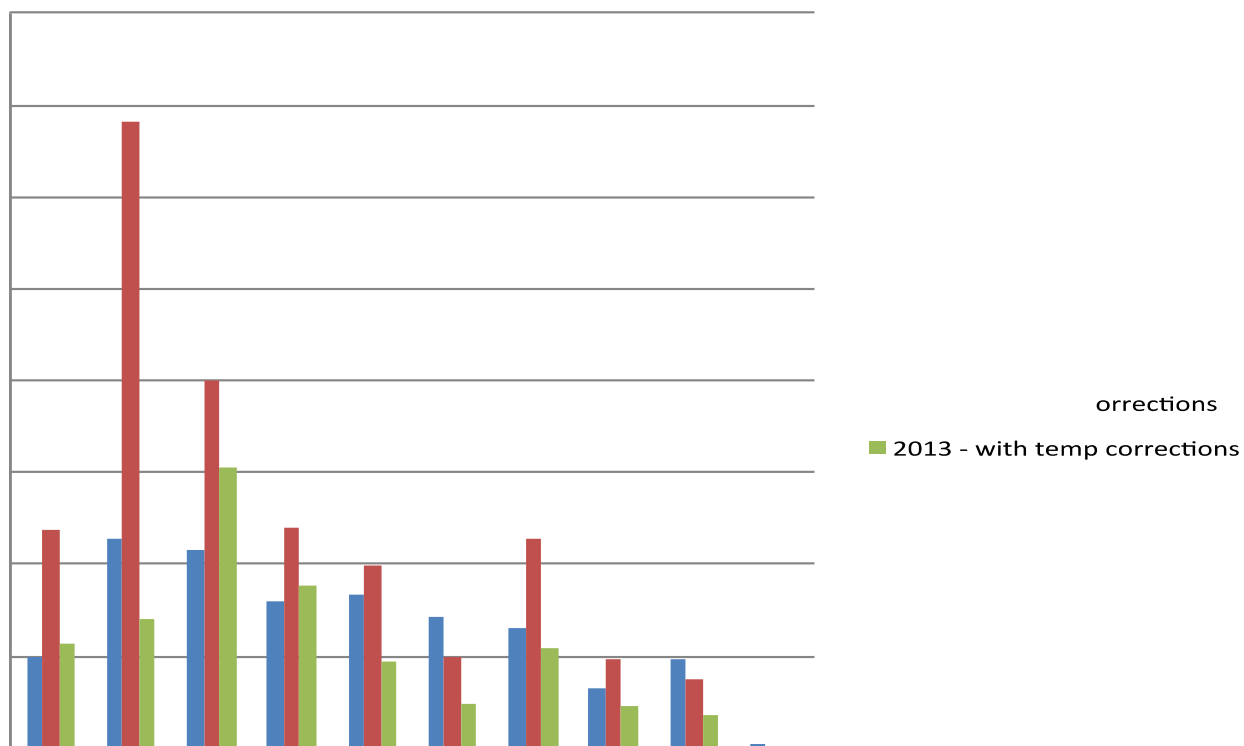


Passive Sampling





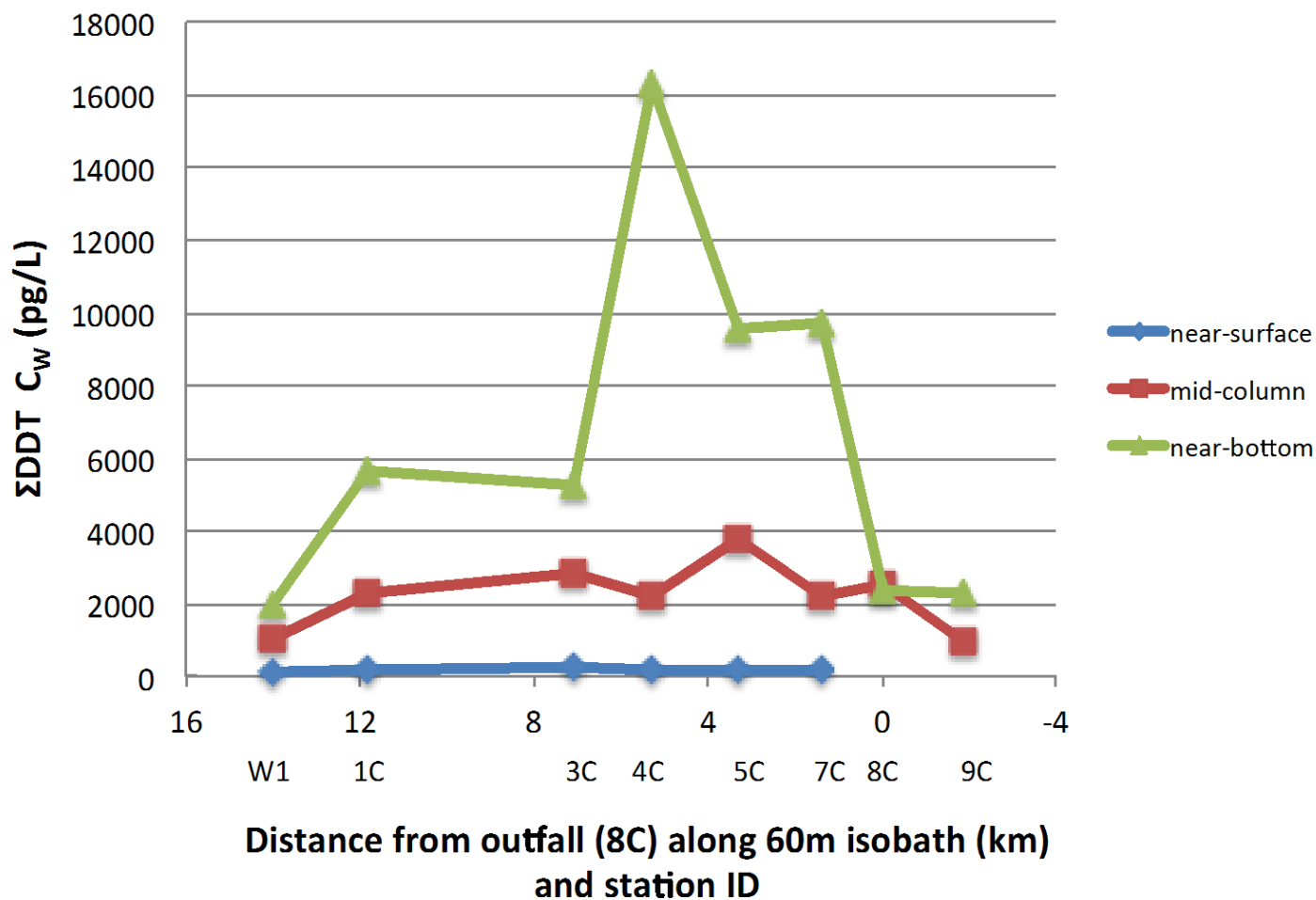
PE Σ DDT Concentration Comparison



Comparison of PE determined Σ DDT C_w from 2010 sampling event and this work (2013). All values are for near-bottom deployment at each station.

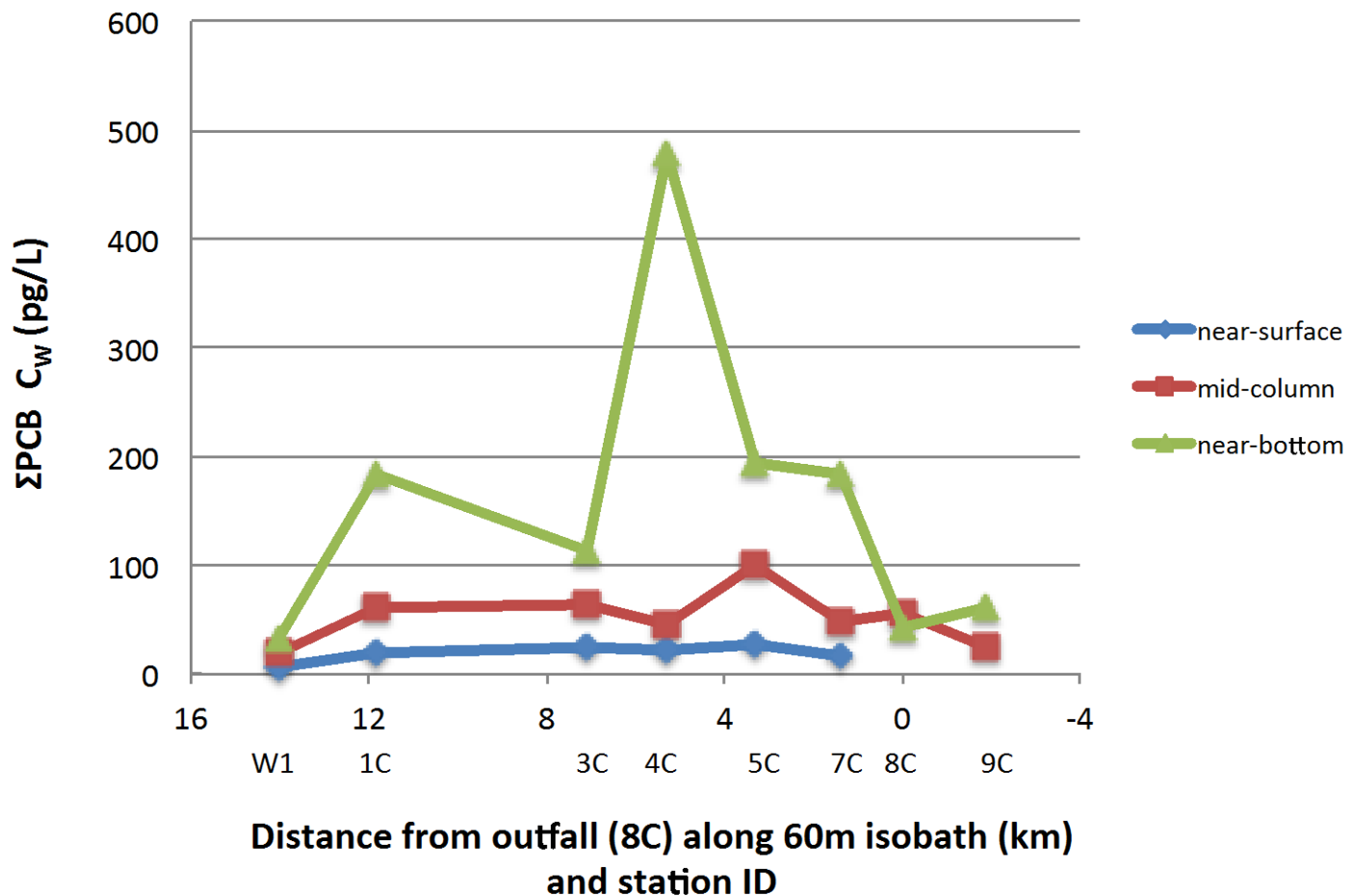


Σ DDT concentrations (60m isobaths)



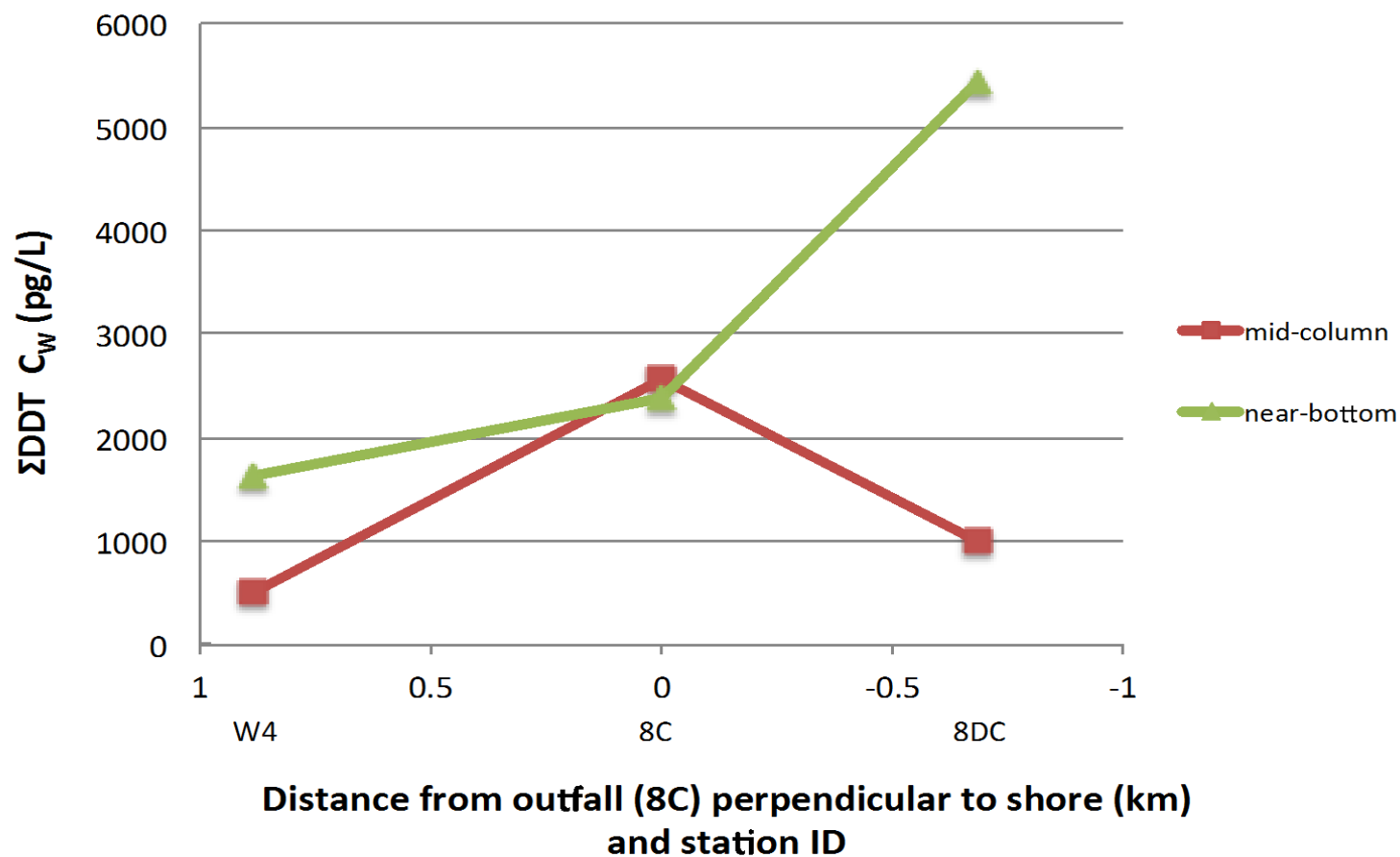


Σ PCB concentrations (60m isobaths)



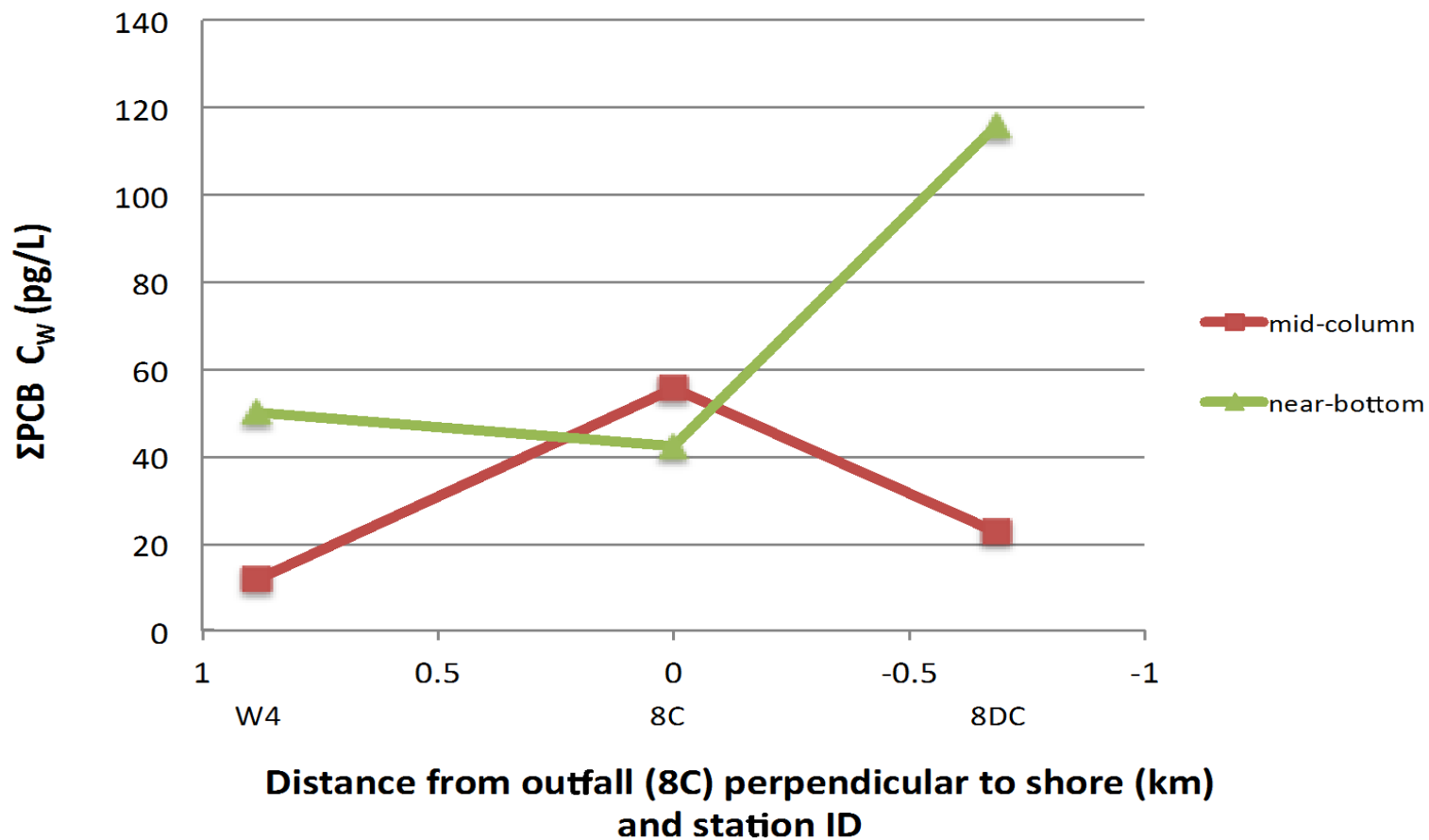


Σ DDT Concentration Perpendicular to Shore





Σ PCB Concentration Perpendicular to Shore





Passive Sampling Study Findings

- **Finding is consistent with previous study:**
 - Water column contaminant concentration is the highest close to the sediment
 - Water column contaminant concentration generally increases down current from 8C and drops off past 4C
- **PE and SPME DDE data are consistent with each other**



High Resolution Pilot Study



High Resolution Sampling

■ **Grab Sampling for High-Resolution Analysis**

Pilot Study Design:

- 17 PSD locations plus 23 Shelf-wide sediment locations
- Depths
 - PSD locations: 2 meters and 5 meters above ocean floor, mid-column, and 5 meters below ocean surface.
 - Shelf-wide locations: 2 meters above ocean floor, mid-column, and 5 meters below ocean surface

■ **Sample Collection Dates:**

- March 31, 2015, September 15, 2015 through September 25, 2015, and November 30, 2015 (resampling due to broken sample bottle)



High Resolution Sampling (cont.)

- **Sample Collection Entity:**

- Kinnetic Laboratories, Inc., Carlsbad, California, using the Sanitation Districts' *Ocean Sentinel* and Kinnetic Lab's *RV D.W. Hood*

- **Analytical Laboratory:**

- ALS Environmental (Burlington, Canada)

- **Sample Analysis Dates:**

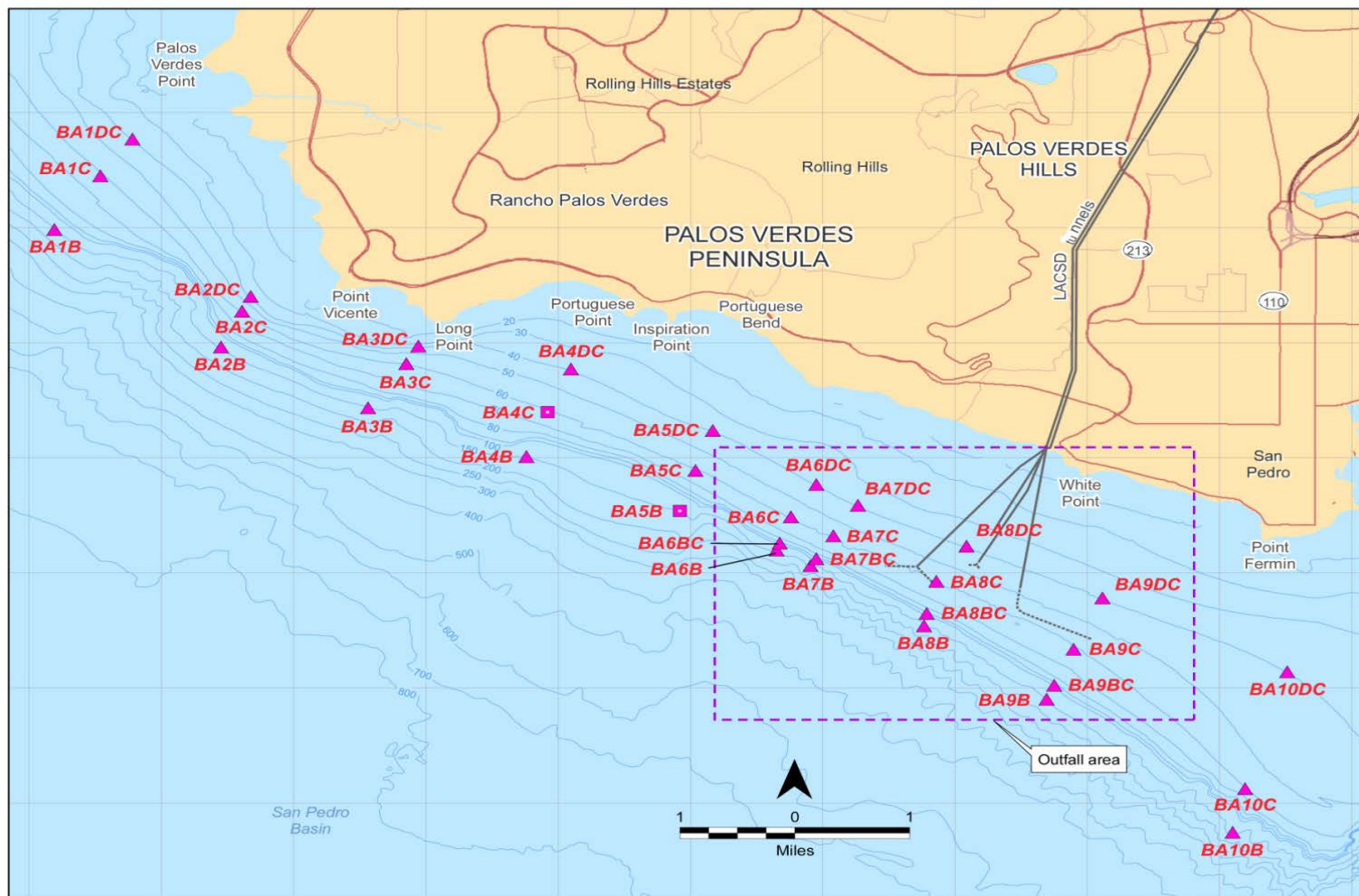
- May, 6, 2015 through January 20, 2016

- **Analytes:**

- DDT Compounds
- PCBs Expanded List

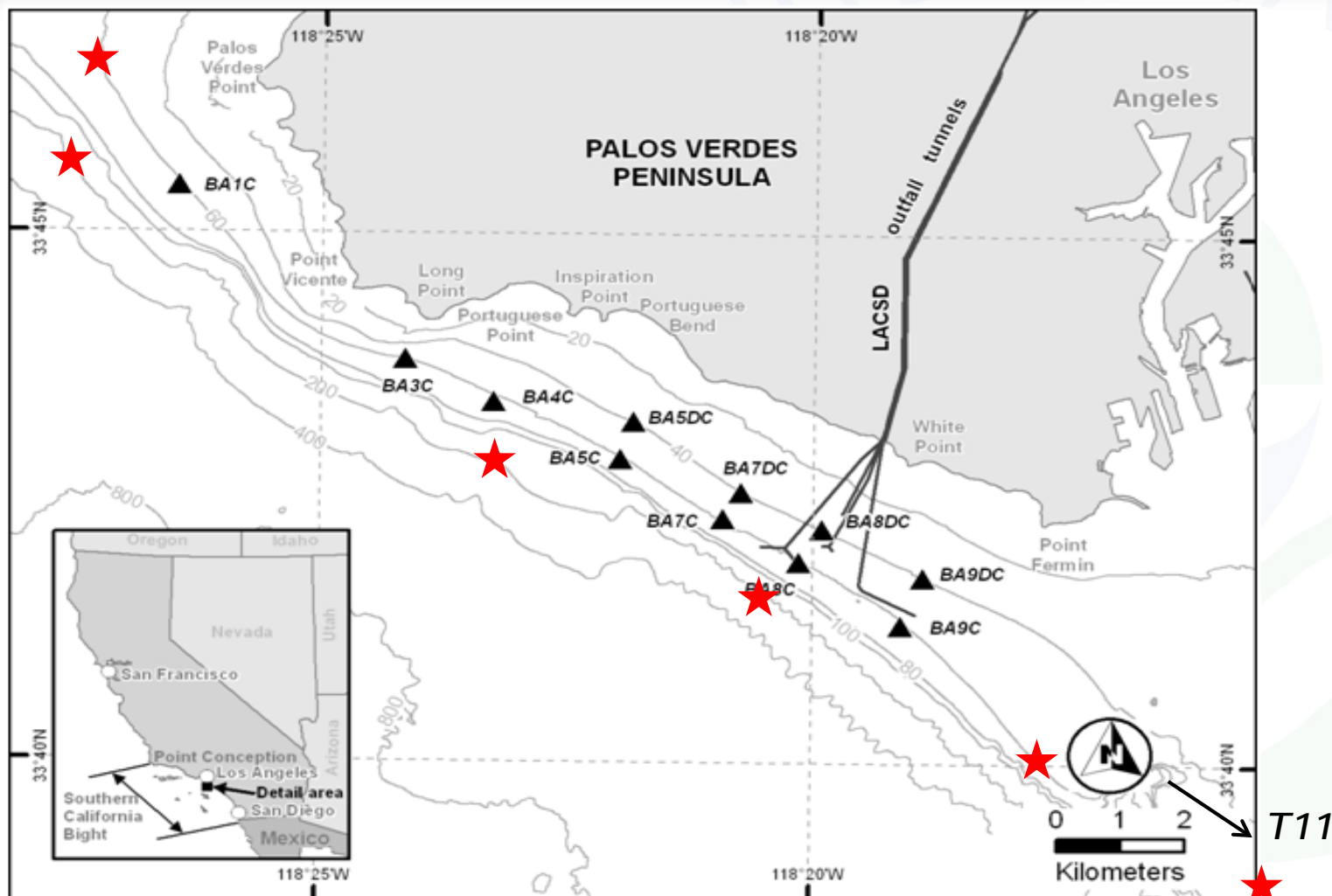


Water Column High Resolution Sampling Locations





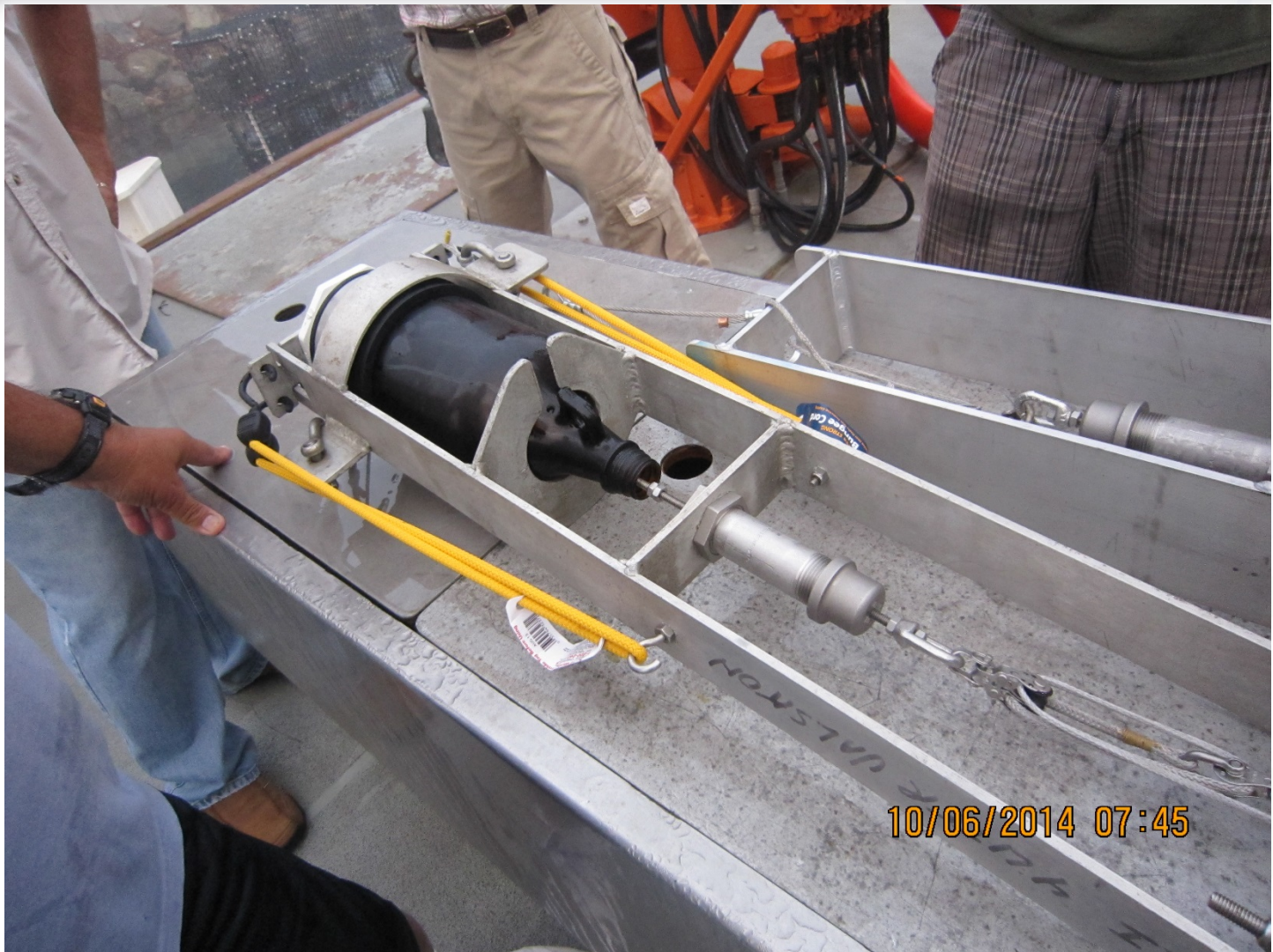
Water Column Passive Sampling Locations



★ Stations outside of the Palos Verdes Shelf Study Area

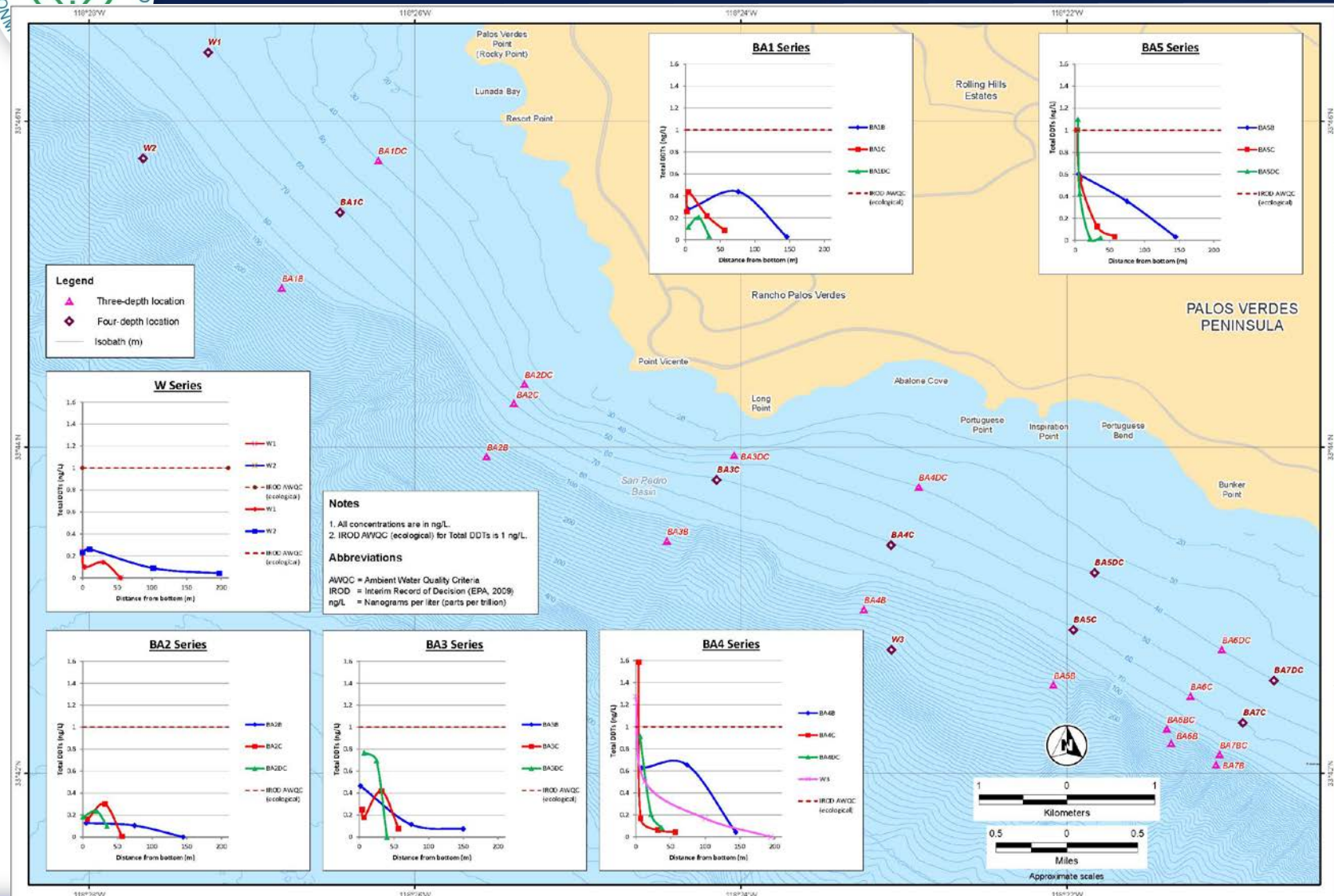


High Resolution Pilot Study



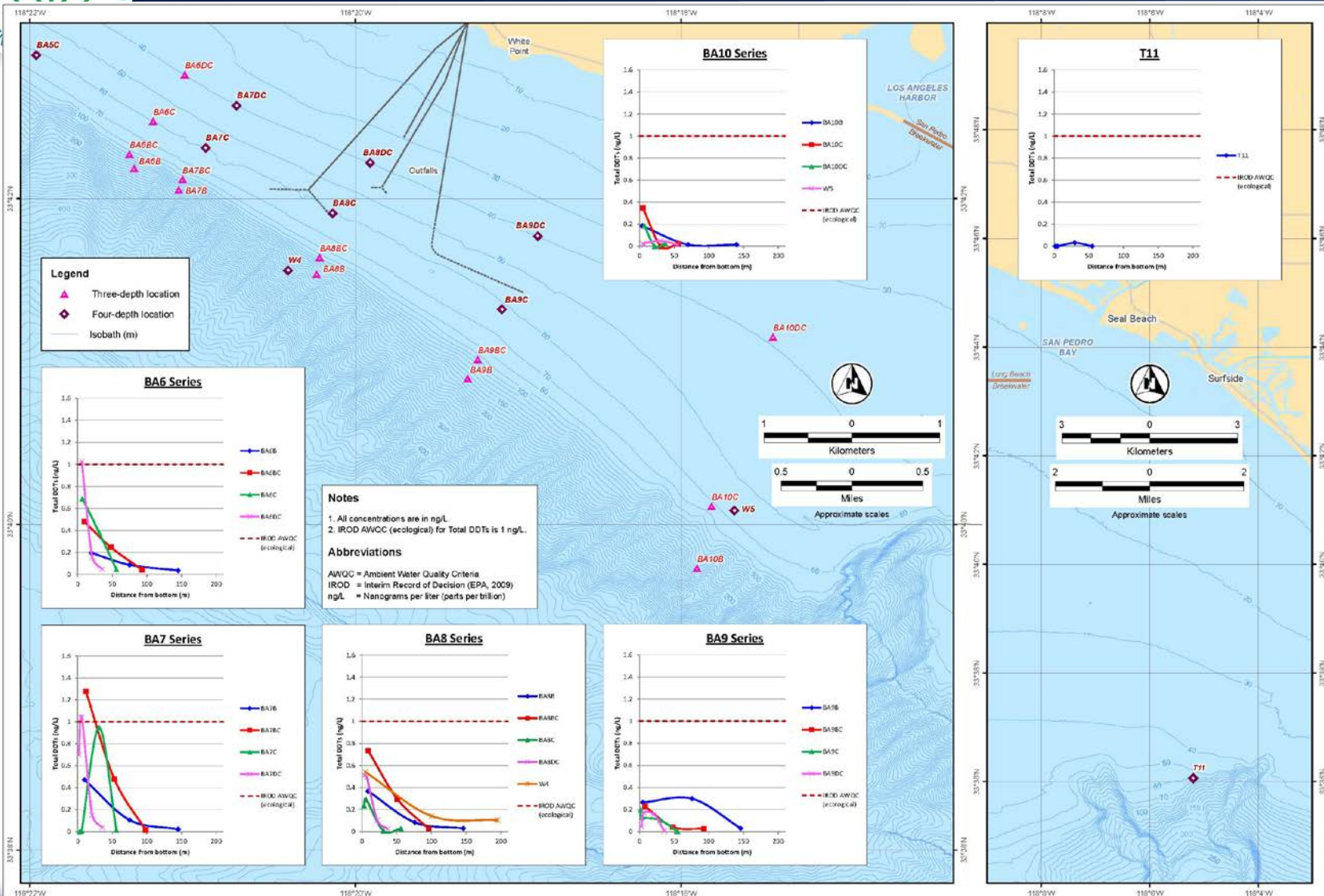


Total DDT Compounds - West



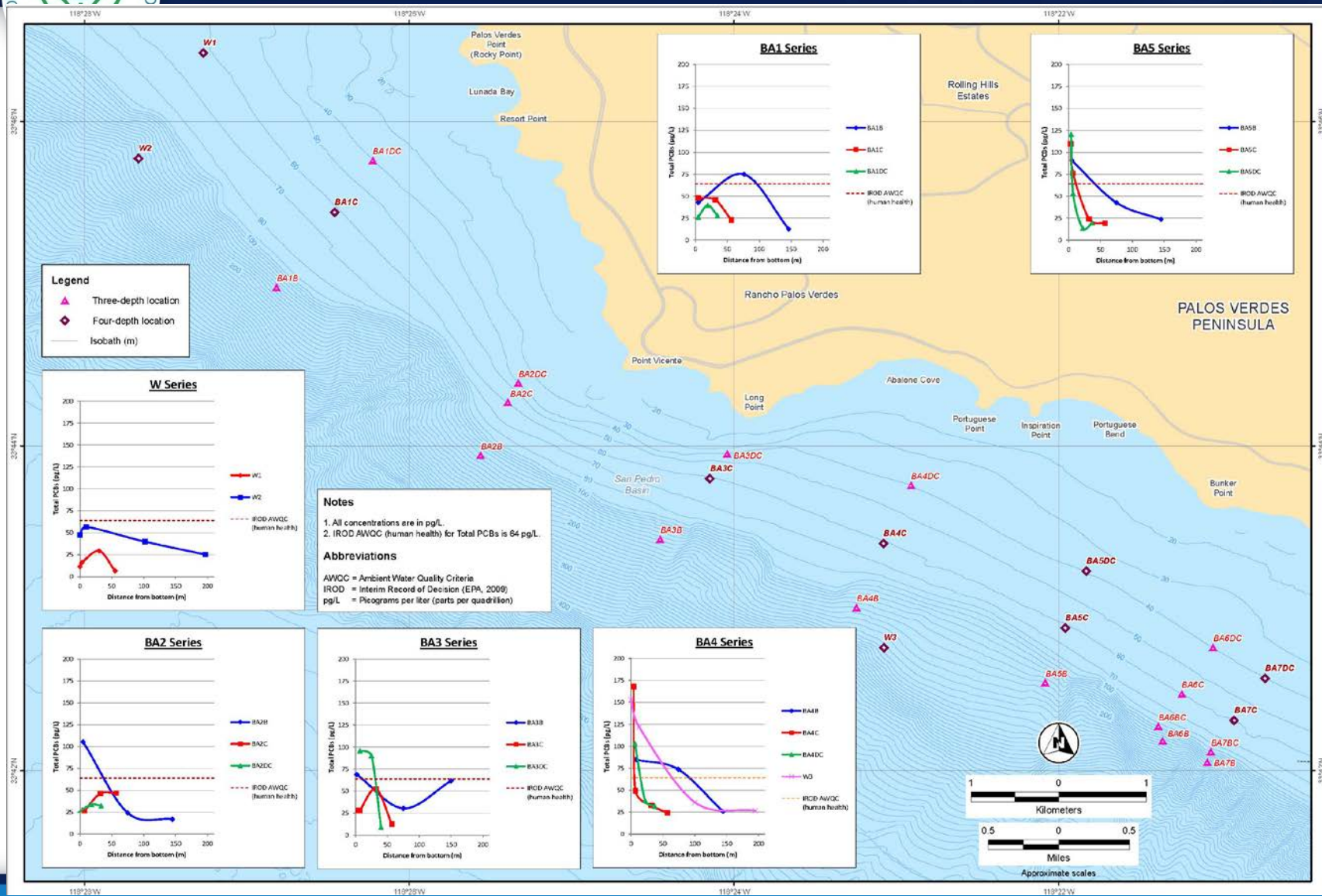


Total DDT Compounds - East



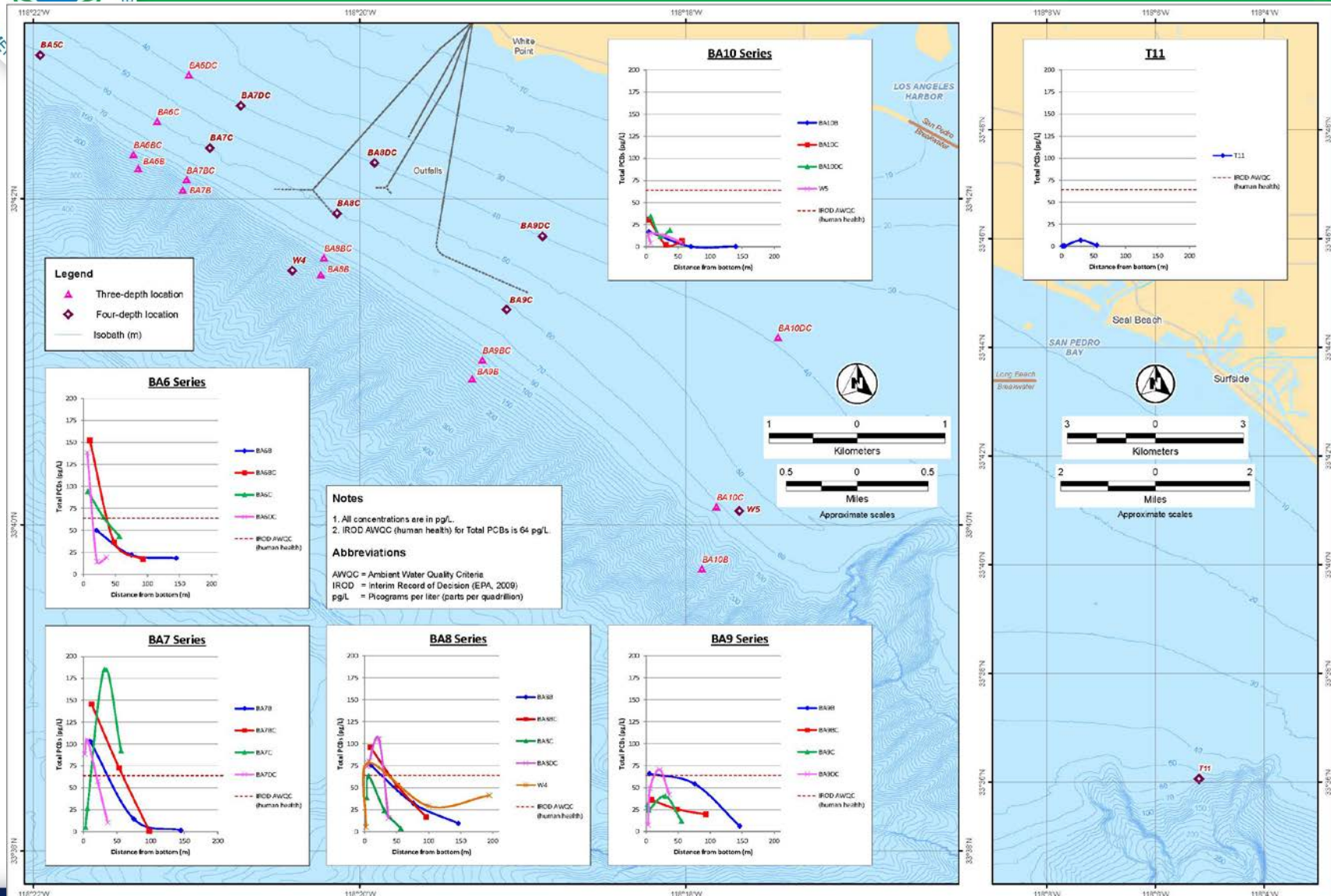


Total PCBs Expanded List - West





Total PCBs Expanded List - East





Results

■ **DDT Compounds:**

- Majority of the stations (except BA4C-Bottom, W3-Bottom, BA6DC-Bottom, BA7DC- Bottom, and BA7BC -Bottom) below IROD ecological protection goal.

■ **PCBs Expanded List:**

- Many stations exceeds IROD human protection goals, including mid-column stations



Total DDTs Water Concentration Comparison

Passive Sampling Vs. Grab

Nominal Sample Depth (m)		Near surface (-5m)				Mid-column (~1/2 total depth)				Near bottom (+5m)				Bottom (+2m)
Sample Type		PED	SPME		Grab	PED	SPME		Grab	PED		SPME		Grab
Location	Total Depth (m)	2013	2010	2013	2015	2013	2010	2013	2015	2010	2013	2010	2013	2015
BA1C	60	117	61	NA	87	1,771	191	NA	219	1,129	4,288	367	NA	434 256
BA3C	60	196	106	NA	76 (223)	2,253	147	NA	419	NA	4,326	455	NA	178 248
BA4C	60	162	76	157	44	1,937	146	826	63	2,613	10,535	960	2,139	170 1,590
BA5C	60	135	134	NA	33	2,614	344	NA	130	2,457	7,012	961	NA	560 1,000 (1,200)
BA5DC	40	196	NA	NA	22	1,493	NA	NA	14	1,765	4,304	NA	NA	430 1,100 (972)
BA7C	60	135	108	154	14	1,736	443	973	949	NA	6,616	1,163	2,669	7 ND
BA7DC	40	136	164	NA	37	1,004	329	NA	151	1,868	2,987	660	NA	1,040 700 (803)*
BA8C	60	NA	51	142	26	1,417	313	841	7.4	1,647	1,520	469	2,053	292 234 (383)*
BA8DC	40	77	78	NA	23	561	189	NA	104	1,500	3,374	328	NA	490 510
BA9C	60	NA	41	114	0.9	517	201	426	103	745	1,238	255	1,013	130 200
BA9DC	40	105	NA	NA	4.1	564	NA	NA	154	1,106	1,331	NA	NA	168 46 (141)*
W1	60	84	NA	NA	NA	854	NA	NA	142	NA	1,534	NA	NA	99 240
W2	200	73	NA	NA	41	335	NA	NA	89	NA	1,191	NA	NA	261 231
W3	200	76	NA	127	ND	409	NA	550	167	NA	1,890	NA	2,151	500 1,270
W4	200	41	NA	NA	103	354	NA	NA	141	NA	1,250	NA	NA	540 107
W5	60	NA	NA	NA	15	NA	NA	NA	48	NA	NA	NA	NA	13 (17) 24
T11	60	ND	ND	72	ND	25	ND	93	31	41	39	ND	ND	ND ND

Notes

1. Analytical results for Total DDTs are in picograms per liter (pg/L, parts per quadrillion).
2. Total DDTs is the sum of six target DDT isomers (o,p'-DDD, o,p'-DDE, o,p'-DDT, p,p'-DDD, p,p'-DDE, and p,p'-DDT).
3. Results in parentheses (223) are replicate sample results. Parentheses with an asterisk (803)* are the higher of two triplicate results.
4. Shaded cells show Total DDTs greater than the IROD AWQC (ecological) of 1 nanogram per liter (ng/L) or 1,000 pg/L. The protectiveness of the 2009 IROD
- DDTs limits may be re-evaluated at the next 5 year review, as individual DDT isomers' AWQCs were updated in 2015.
5. In calculating summations of Total DDTs, nondetects were assumed to have a value of zero.



Total PCBs Water Concentration Comparison Passive Sampling Vs. Grab

Nominal Sample Depth (m)		Near surface (-5m)		Mid-column (~1/2 total depth)		Near bottom (+5m)		Bottom (+2m)
Sample Type		PED	Grab	PED	Grab	PED		Grab
Location	Total Depth (m)	2013	2015	2013	2015	2010	2013	2015
BA1C	60	13	23	46	46	127	138	48 46
BA3C	60	20	13 (19)	50	52	NA	93	28 28
BA4C	60	17	24	38	33	287	309	50 170
BA5C	60	18	19	69	24	187	141	76 110 (140)
BA5DC	40	23	20	39	14	168	85	53 120 (110)
BA7C	60	13	92	36	190	NA	125	27 5.2
BA7DC	40	15	11	24	58	143	62	100 88 (87)*
BA8C	60	NA	3.8	31	24	132	27	63 39 (25)
BA8DC	40	10	16	13	110	126	72	80 74
BA9C	60	NA	12	13	41	58	32	25 31
BA9DC	40	12	42	13	70	87	24	49 7.4 (8.6)
W1	60	5	6.5	16	29	NA	26	16 11
W2	200	4	25	7	40	NA	30	57 48
W3	200	6	27	8	36	NA	52	120 150
W4	200	4	41	8	29	NA	38	78 5.1
W5	60	NA	5.0	NA	13	NA	NA	3.9 (3.9) 15
T11	60	1	1.3	1	6.8	9.3	2	0.52 0.51

Notes

1. Analytical results for Total PCBs are in picograms per liter (pg/L, parts per quadrillion).
2. Total PCBs is the sum of various congener lists.
3. Results in parentheses (140) are replicate sample results. Parentheses with an asterisk (87)* are the higher of two triplicate results.
4. Shaded cells show Total PCBs greater than the IROD AWQC (human health) of 0.064 nanograms per liter (ng/L) or 64 pg/L.
The protectiveness of the 2009 IROD PCBs limits may be re-evaluated at the next 5 year review.
5. In calculating summations of Total PCBs, nondetects were assumed to have a value of zero.
PED results include 44 PCB congeners (not including PCB31, 195, 203; including PCB200), PRC adjusted.
Grab sample results include 46 PCB congeners (not including PCB200), adjusted with labeled isotopic surrogates.