PORTLAND HARBOR RI/FS

REMEDIAL INVESTIGATION REPORT

APPENDIX H
BACKGROUND SUPPORTING INFORMATION

FINAL

(ProUCL Output and Final Portland Harbor Sediment Background Provided in Separate Files)

February 8, 2016

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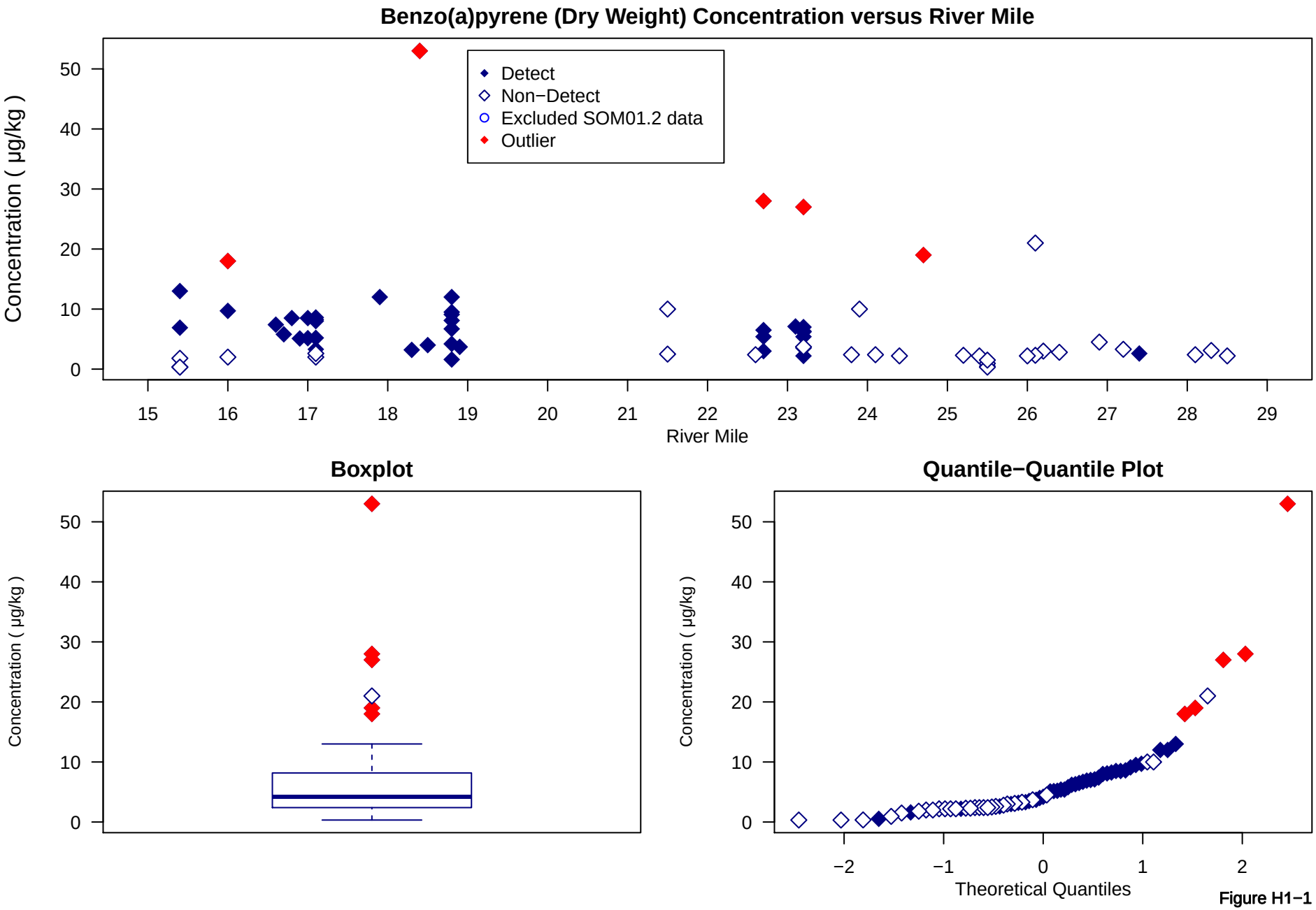
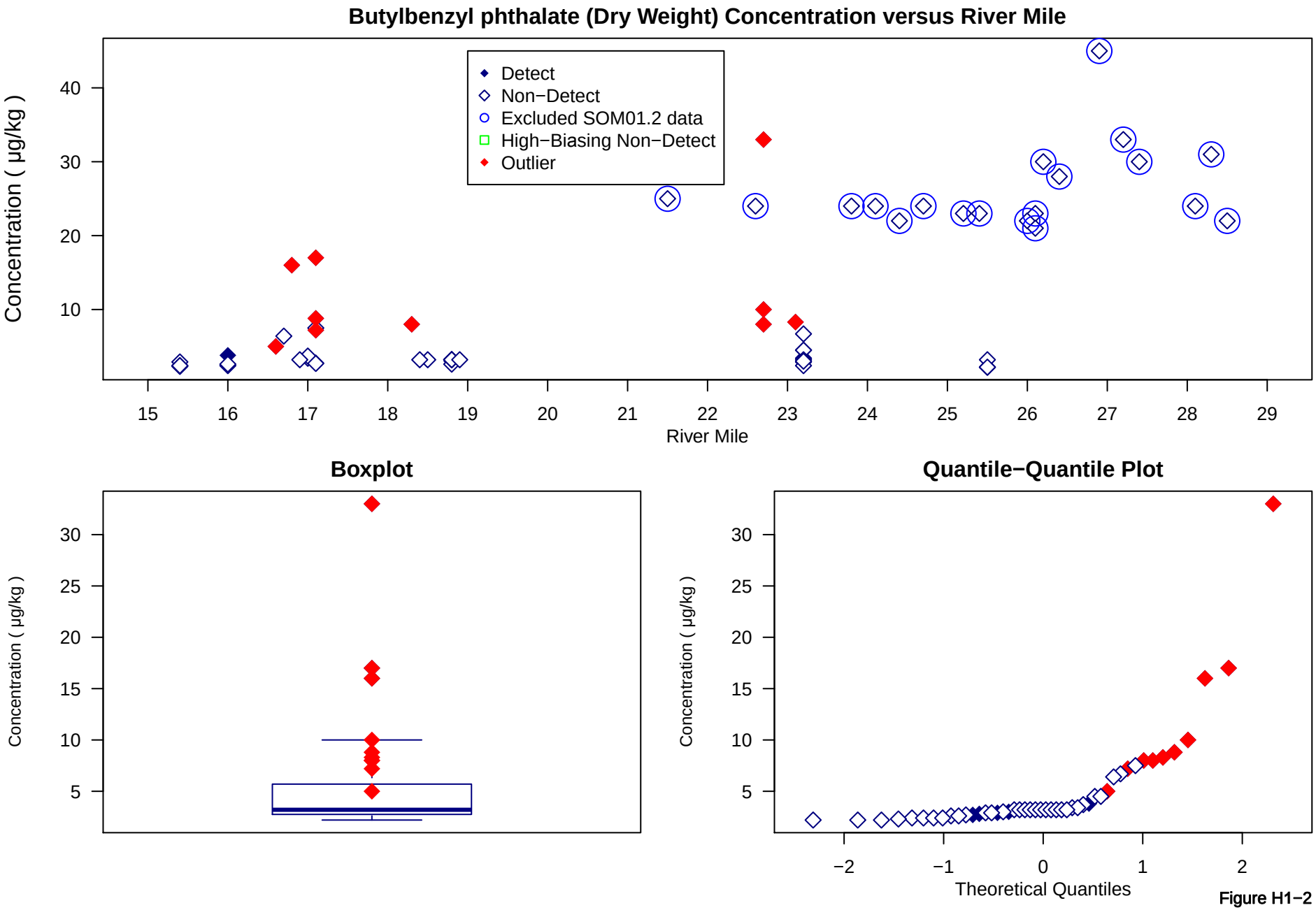


Figure H1−1
Portland Harbor RI/FS
Remedial Investigation Report
Background Upriver Bedded Sediment Outlier Analysis
Benzo(a)pyrene (Dry Weight)



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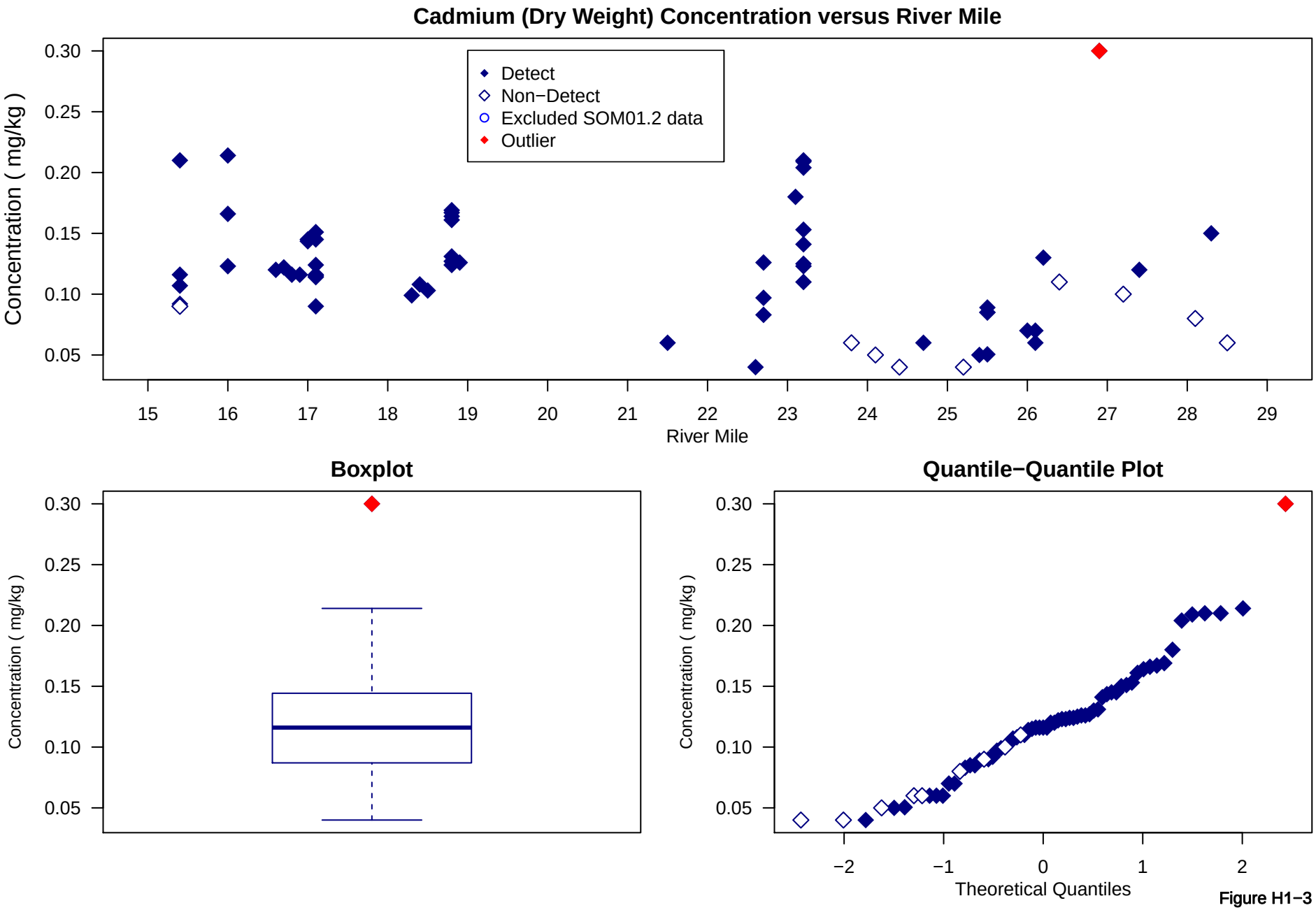

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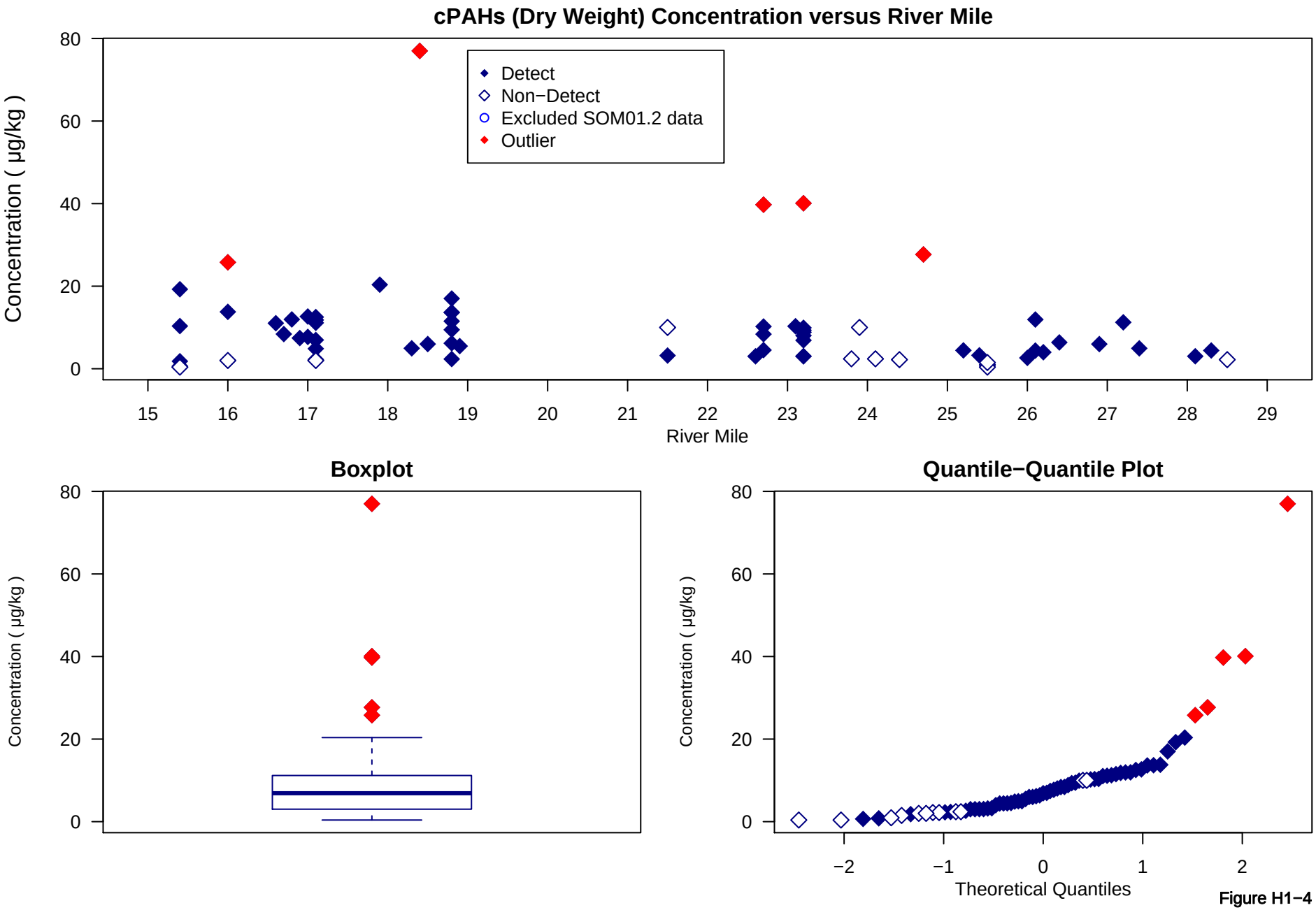

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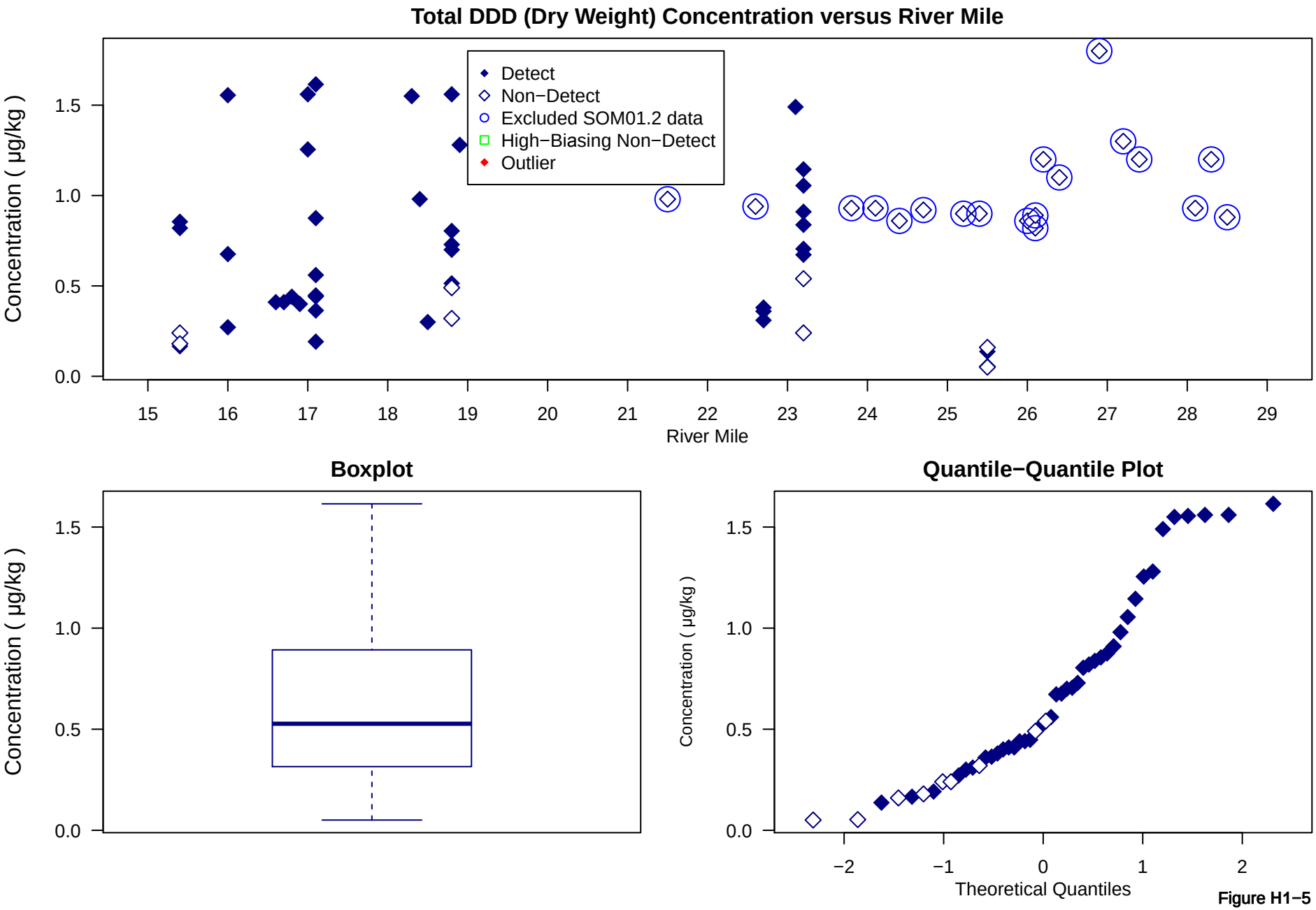

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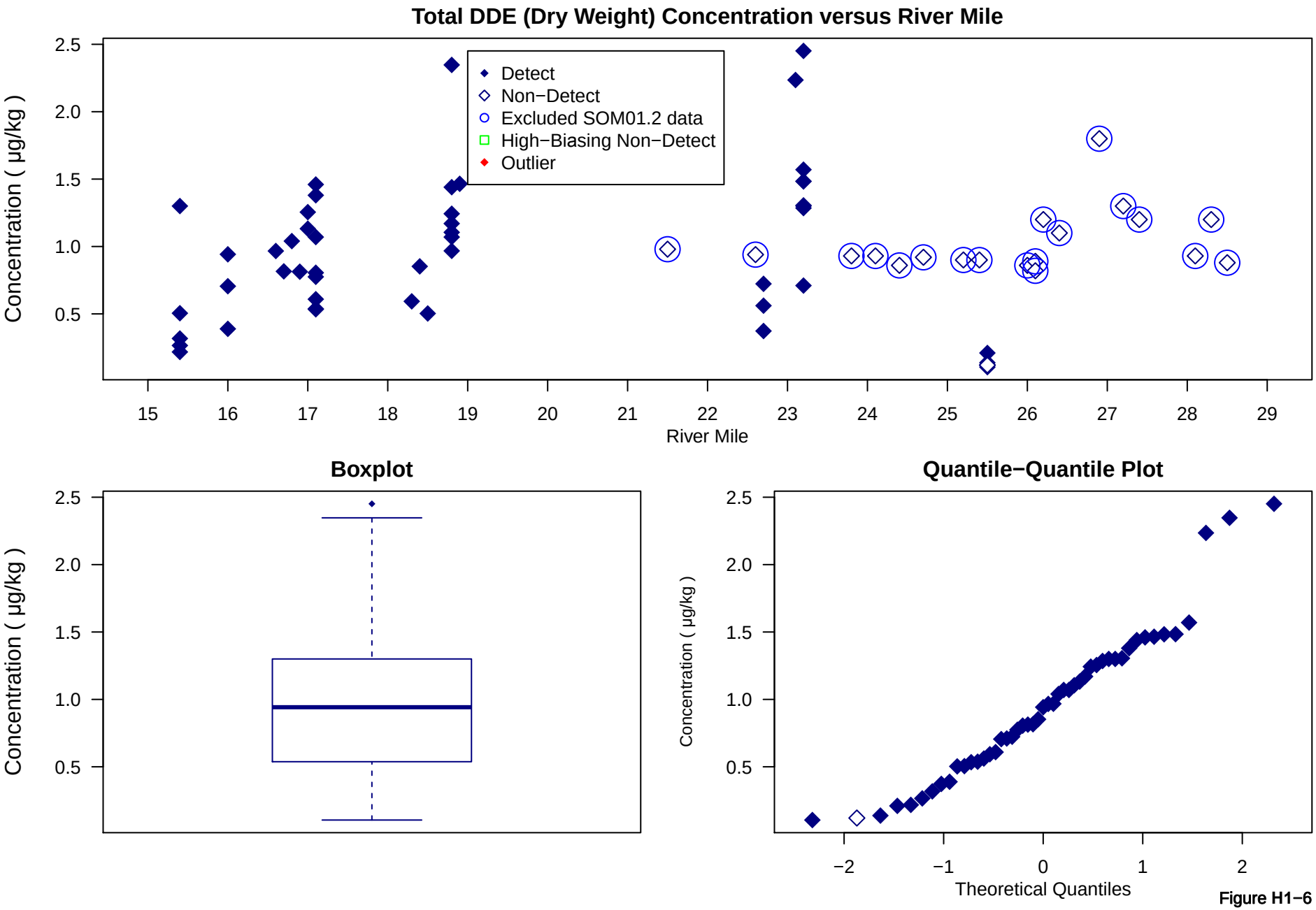

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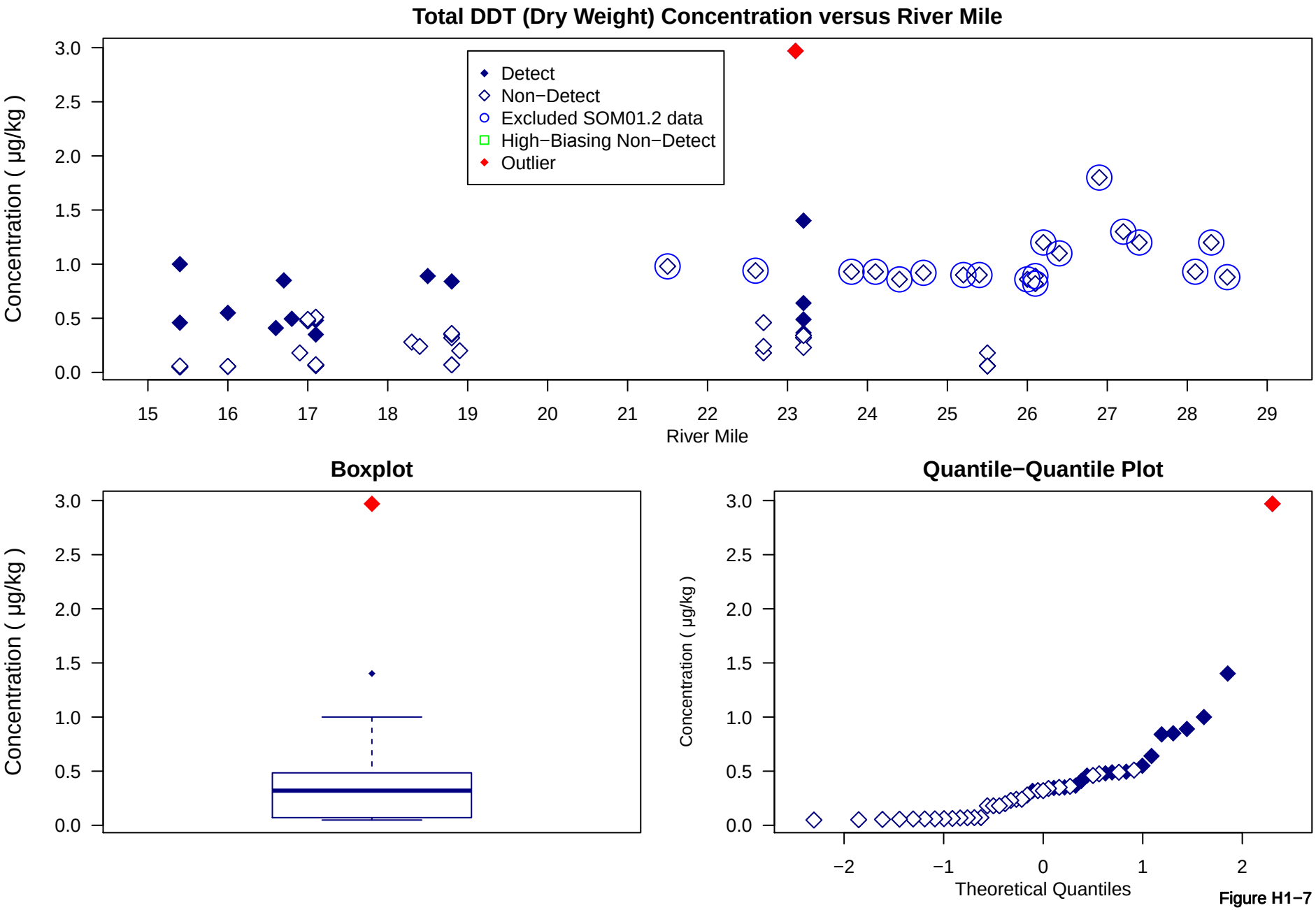

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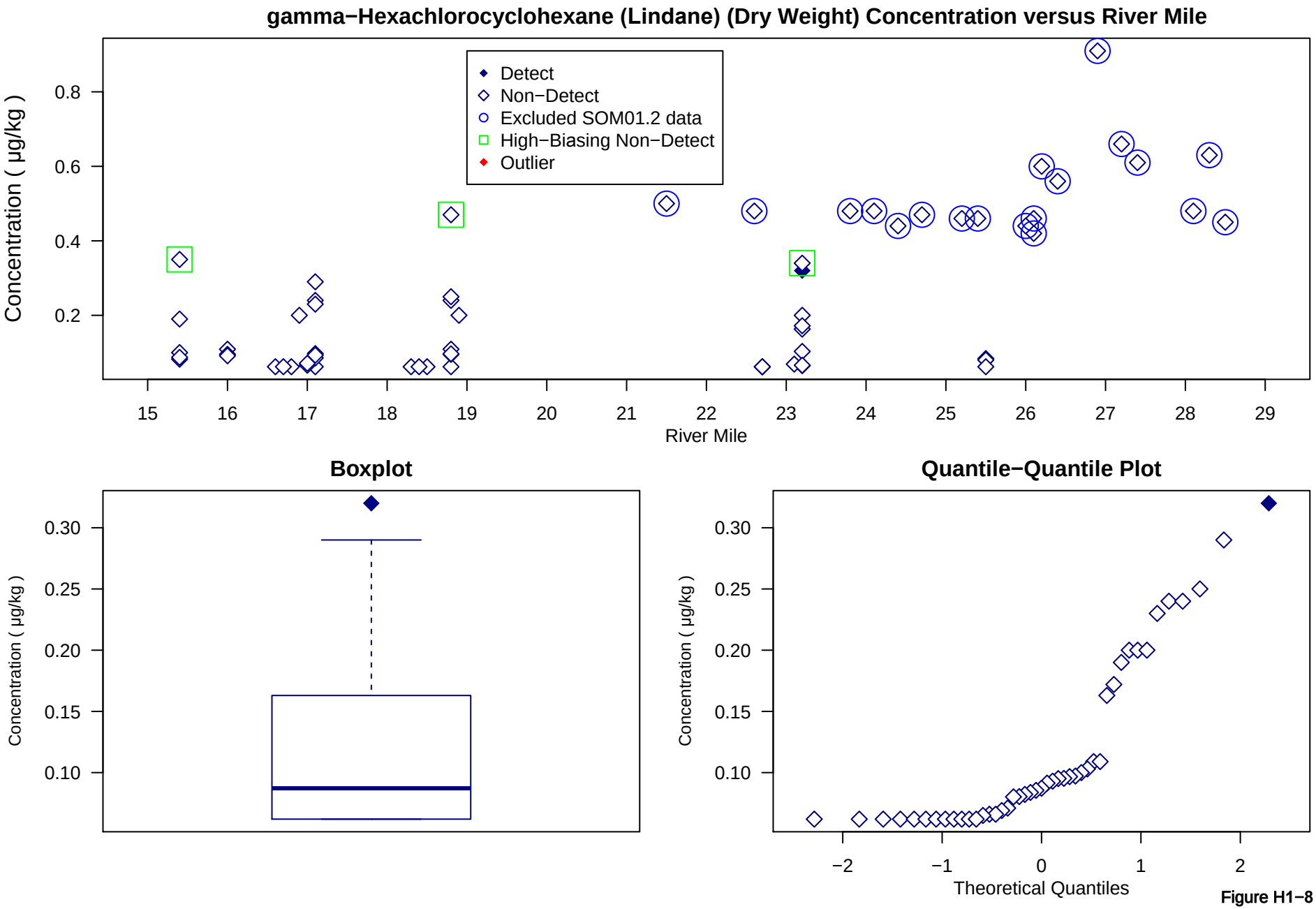

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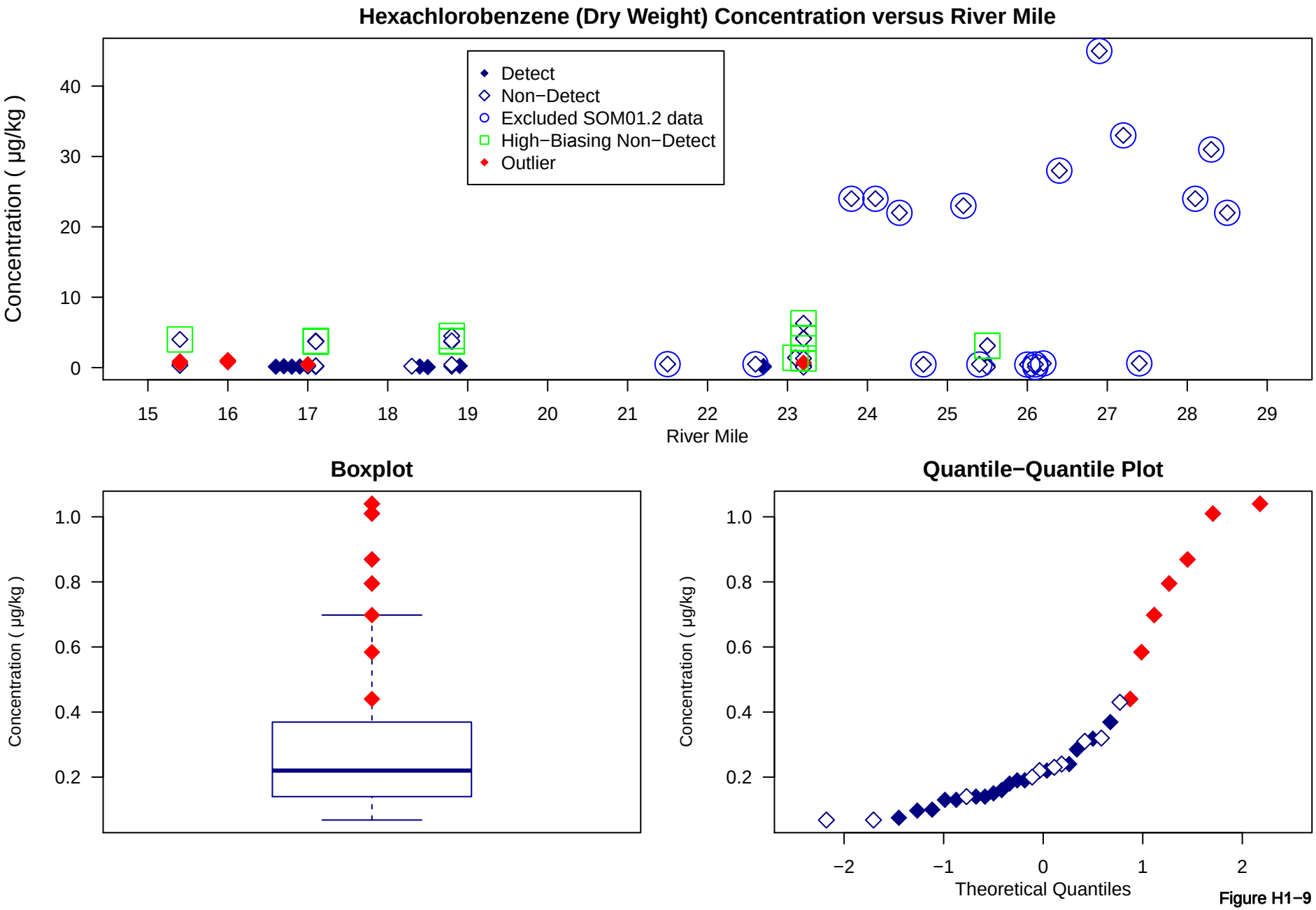

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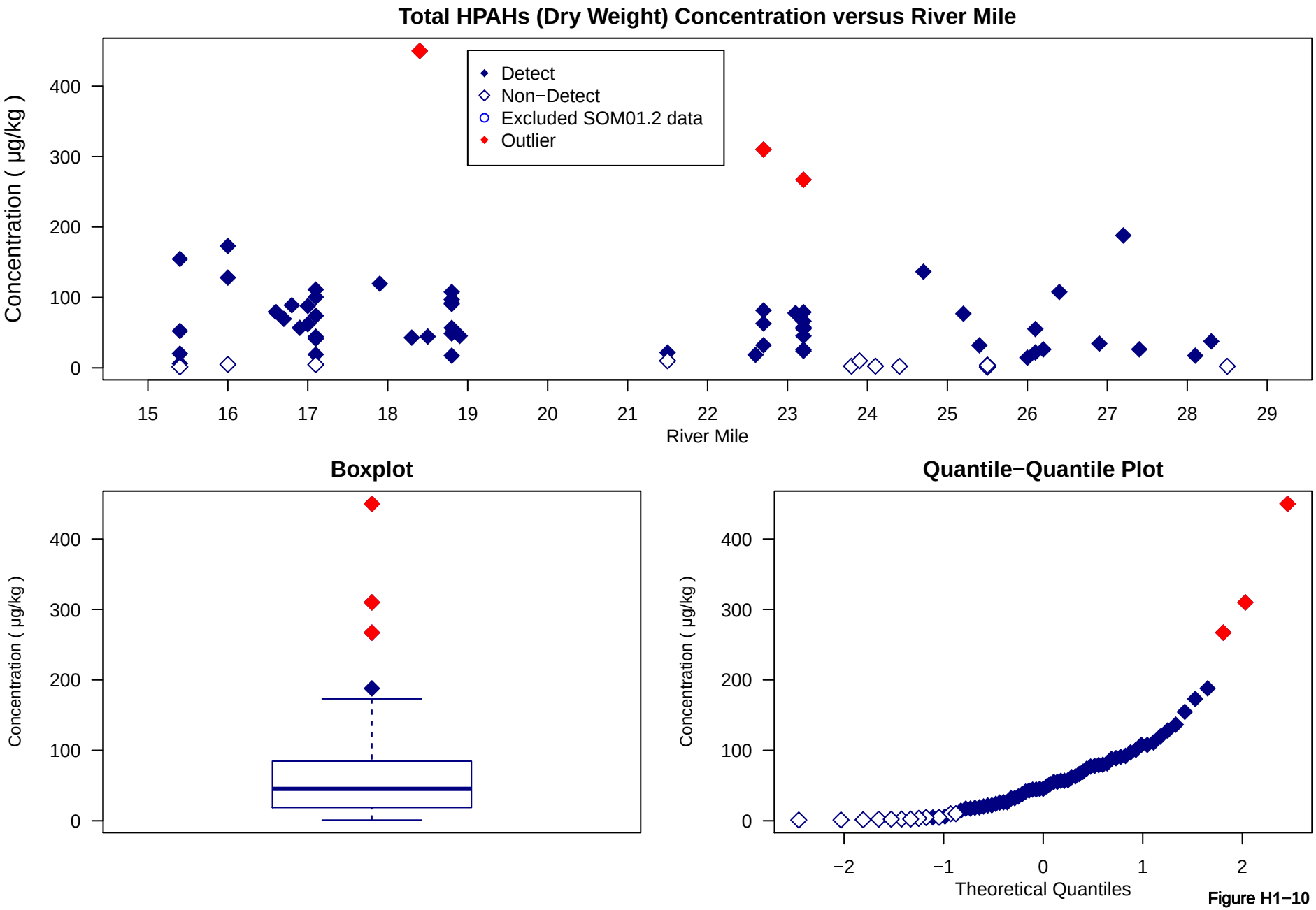

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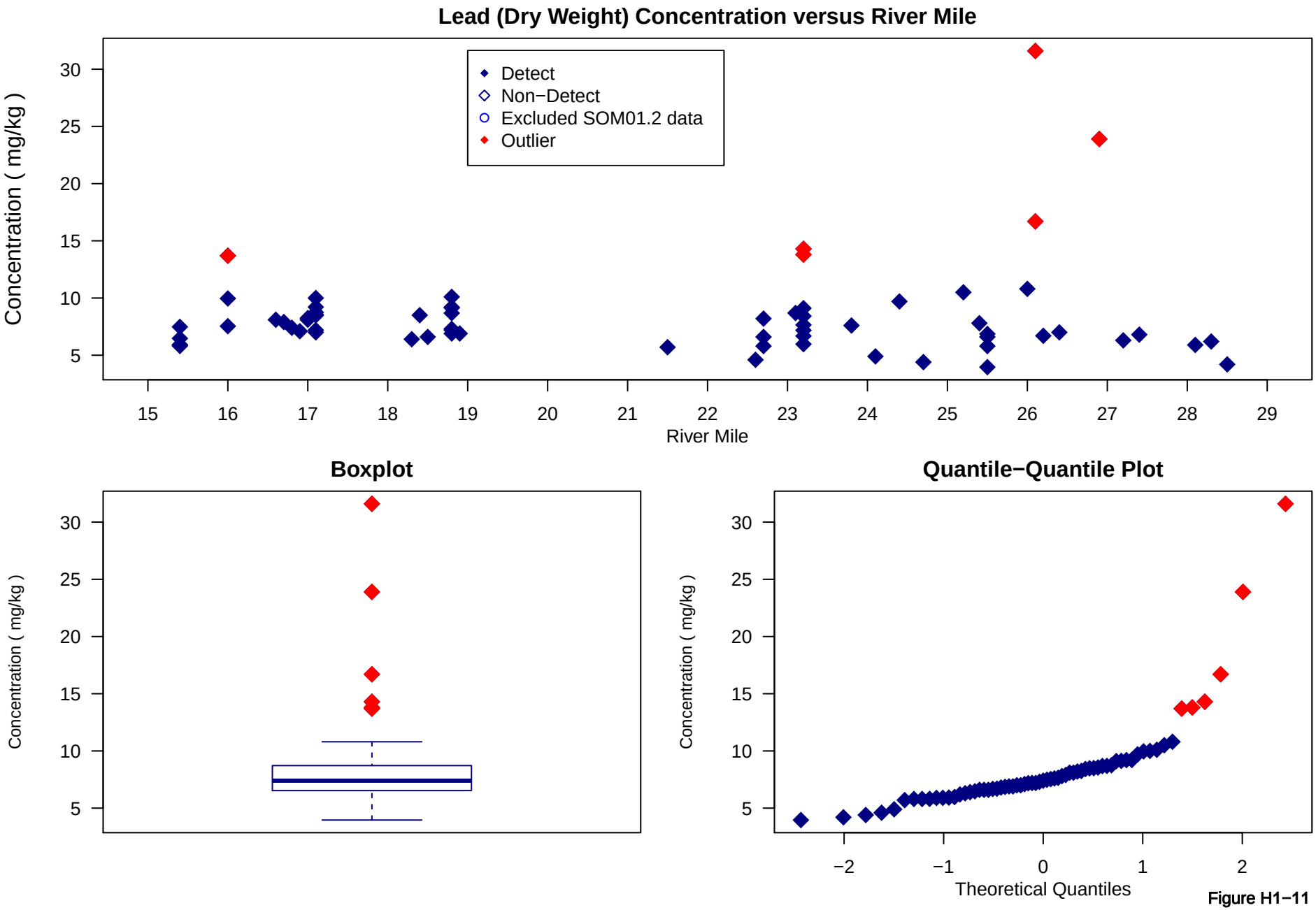

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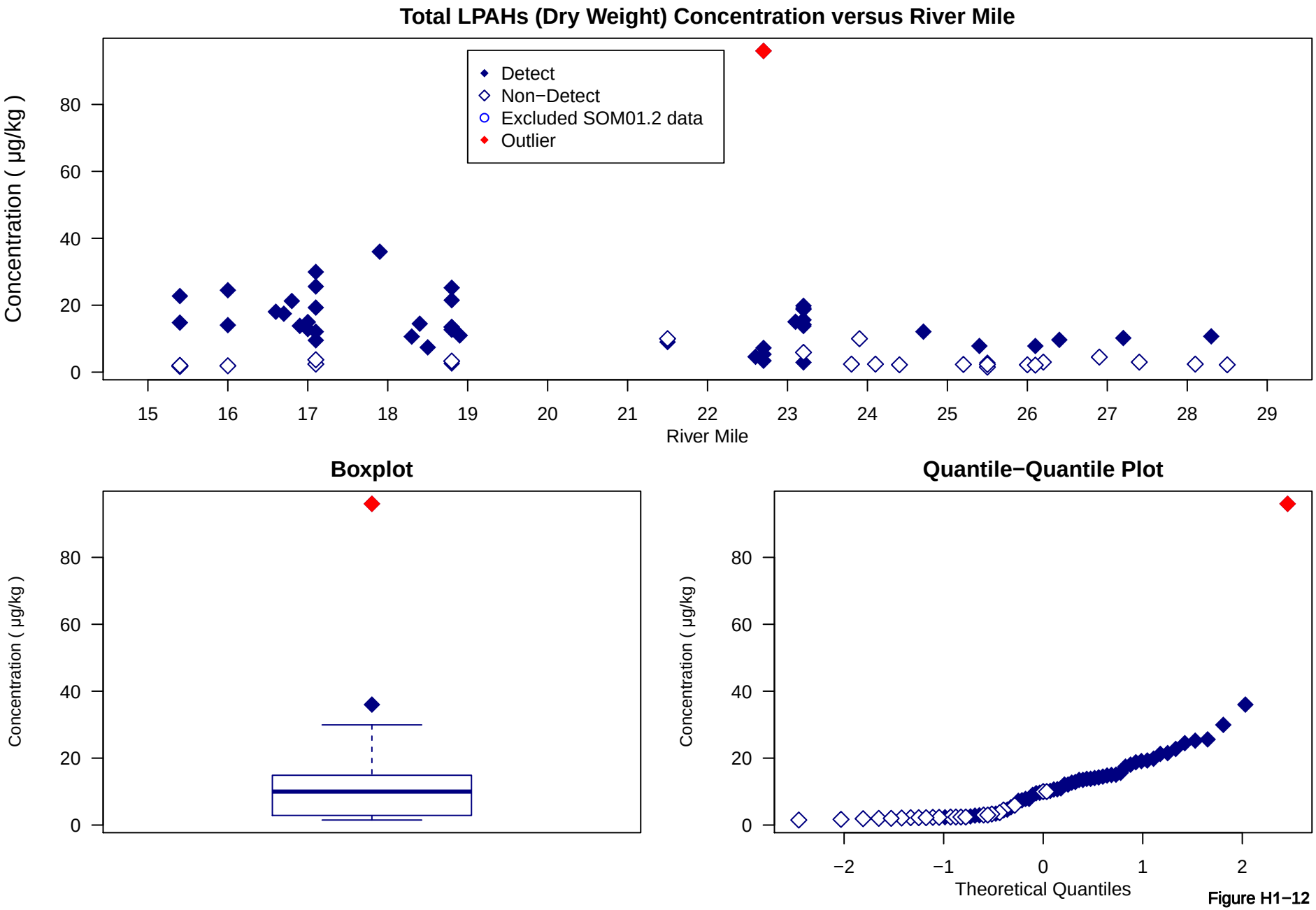

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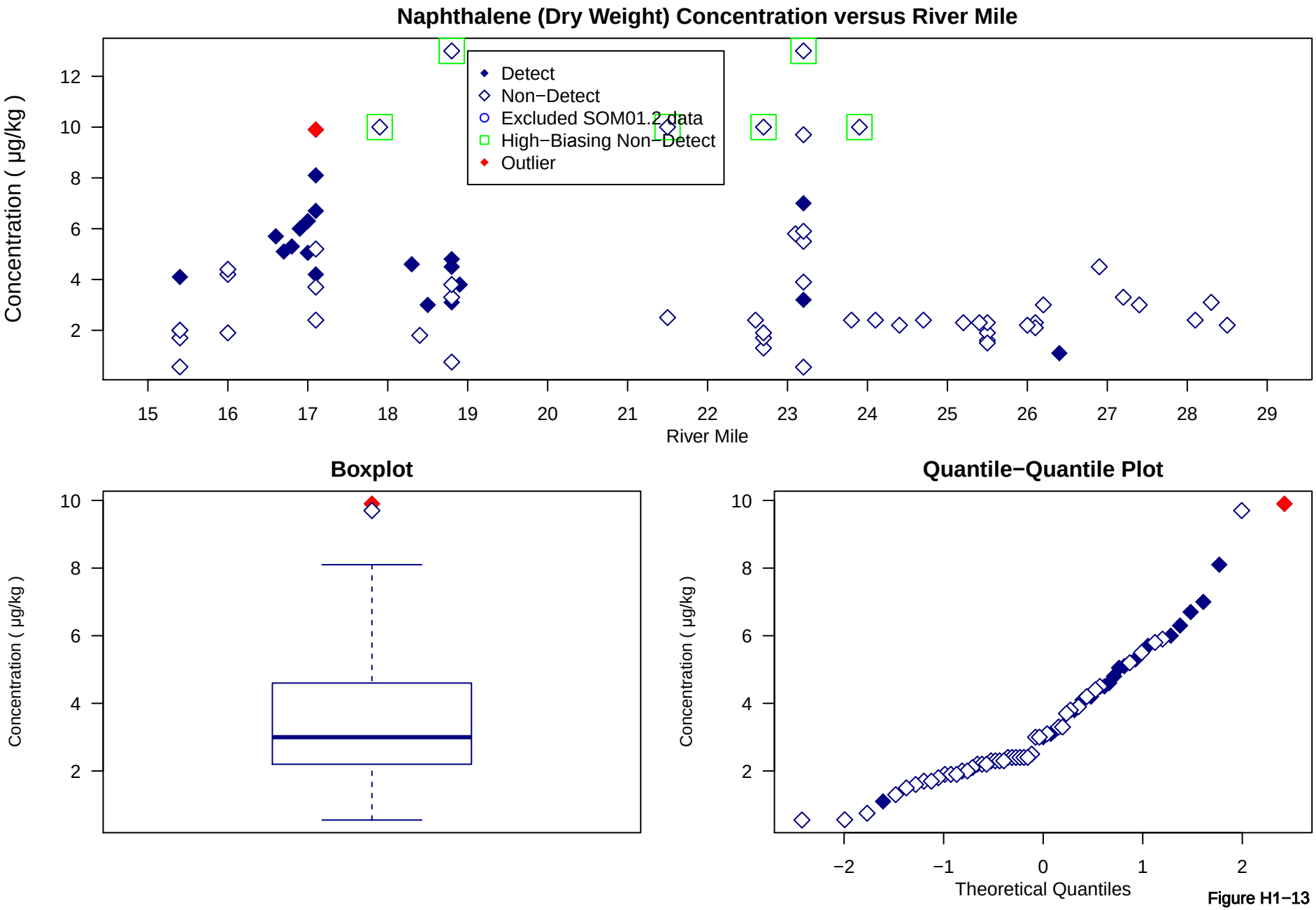

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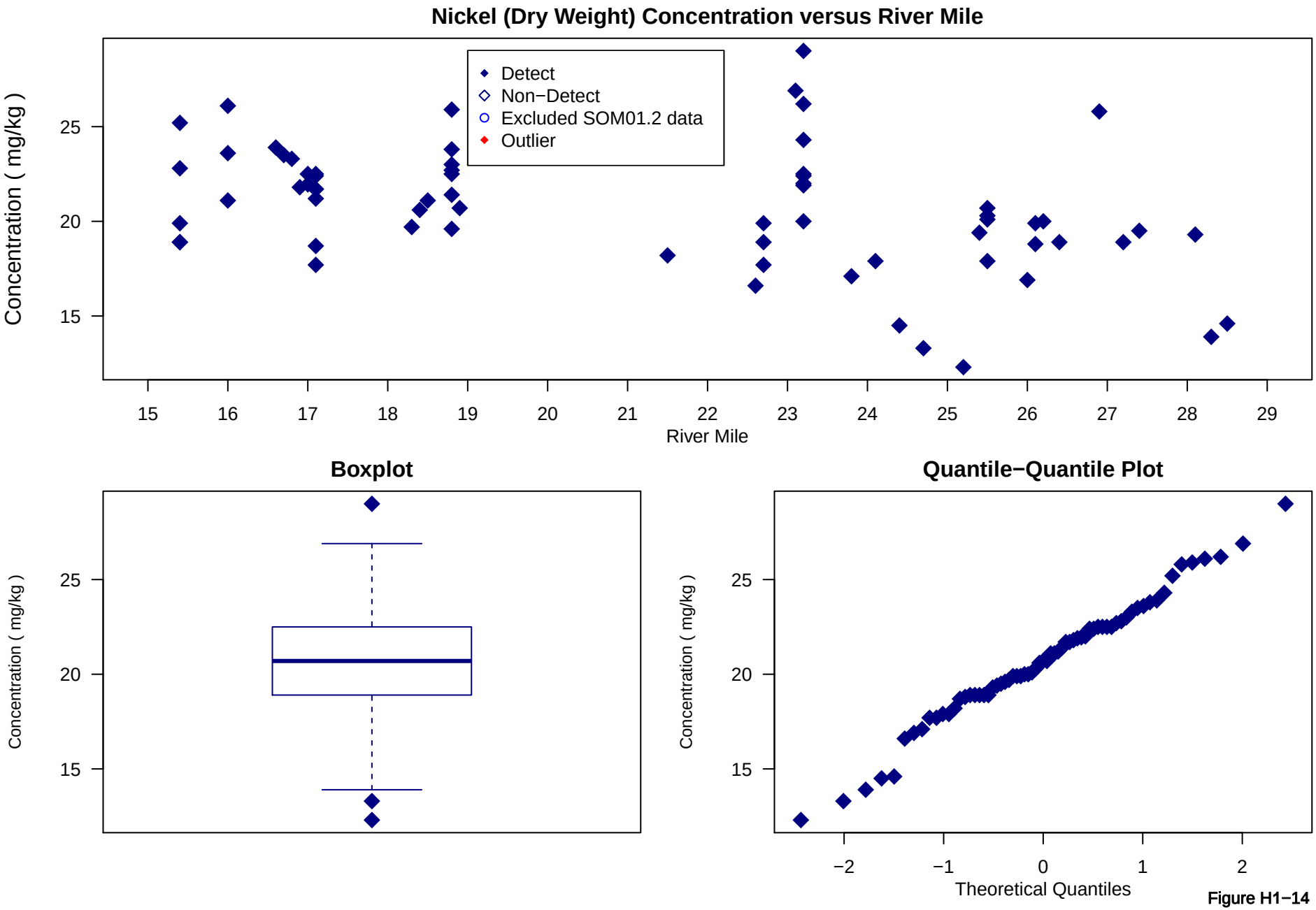

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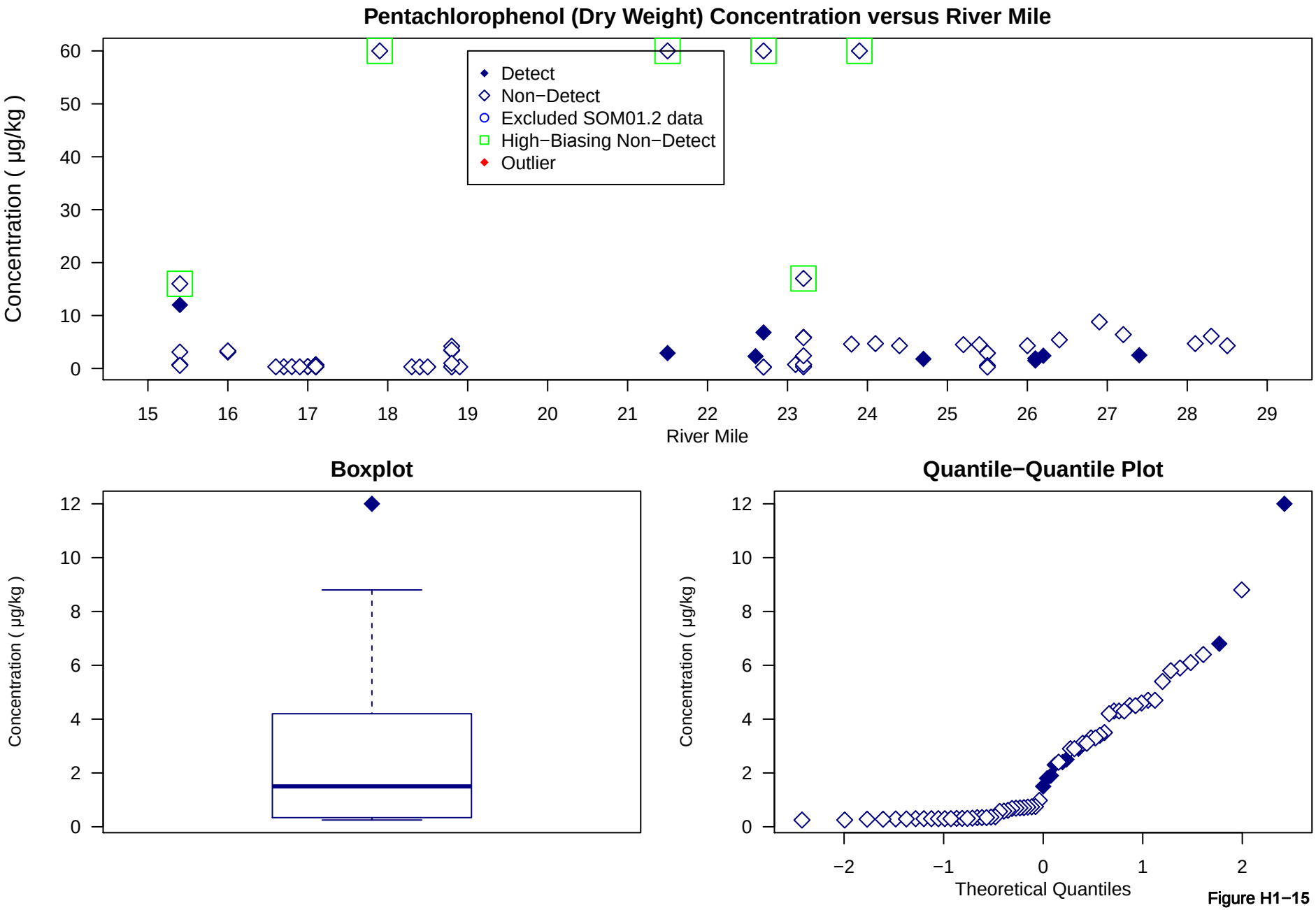

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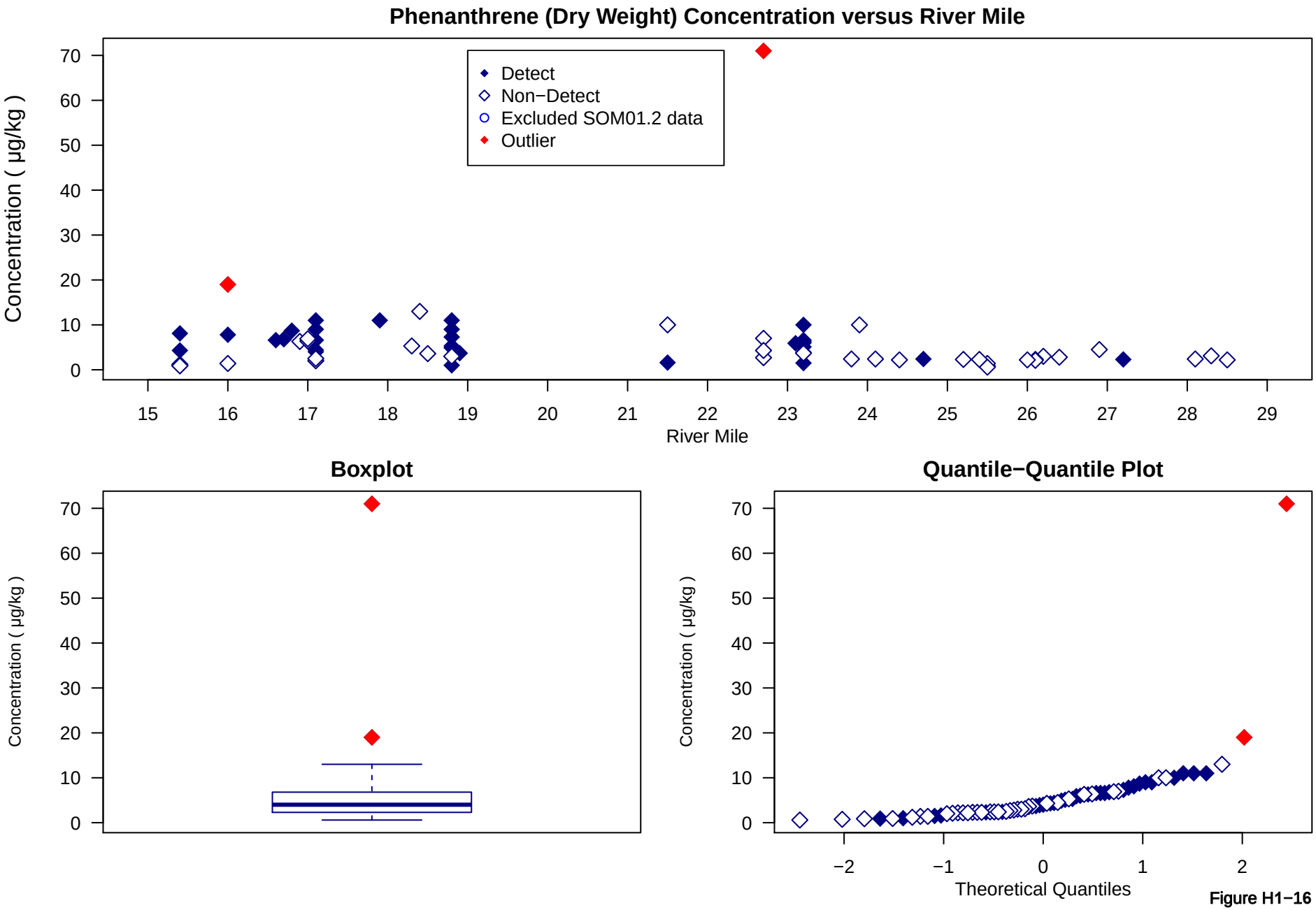

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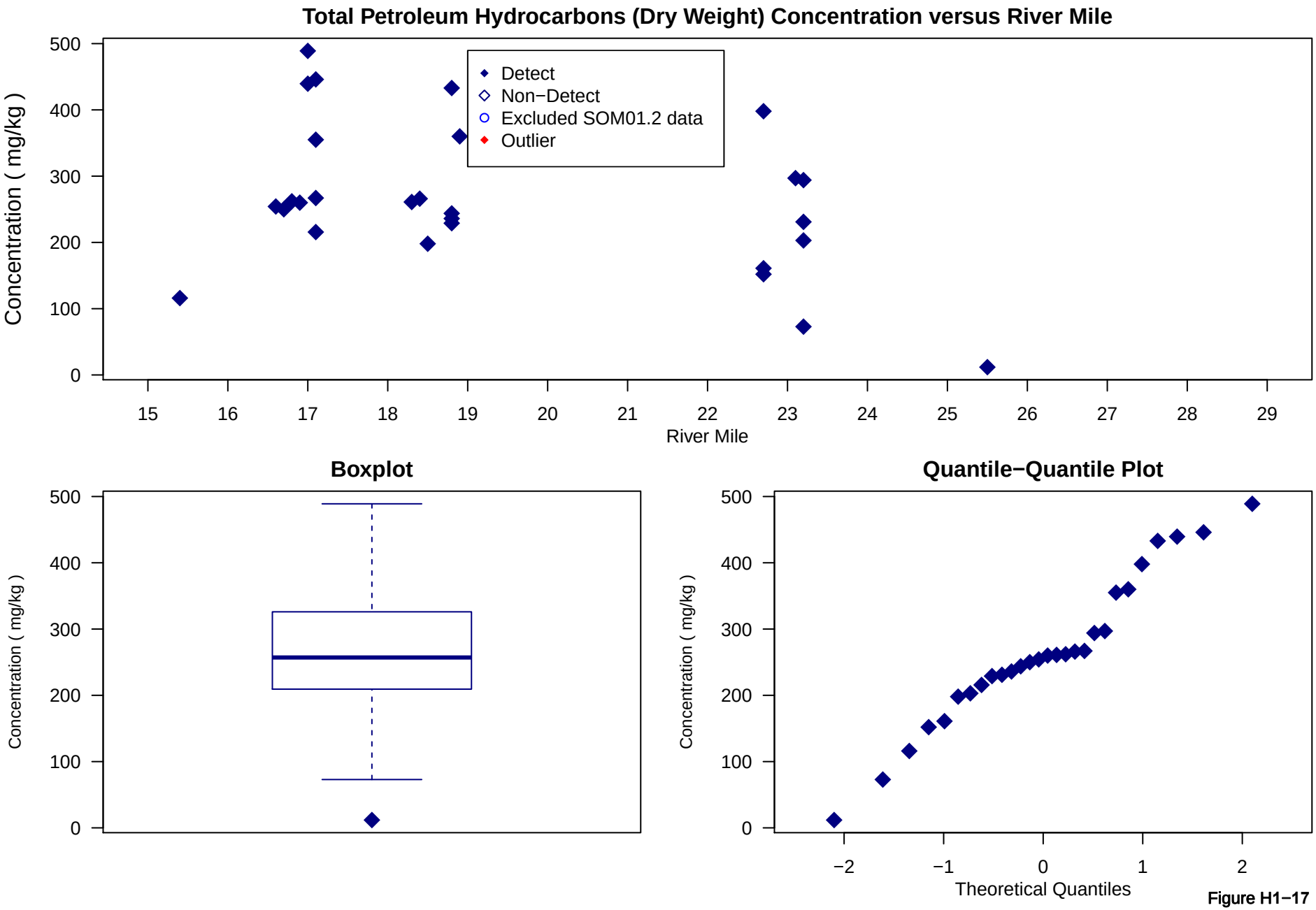

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Total Petroleum Hydrocarbons (Dry Weight)

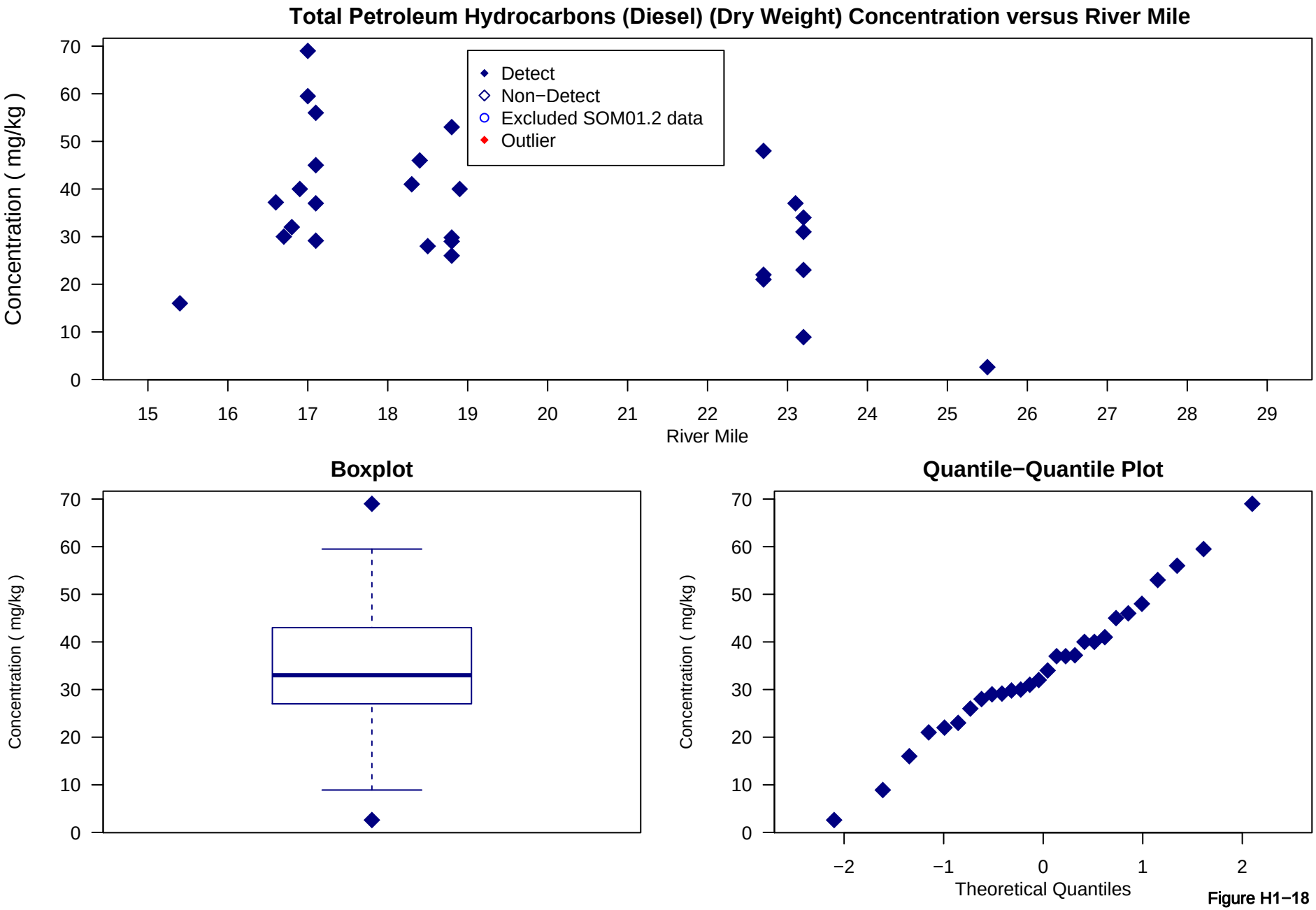

Figure H1−18
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Total Petroleum Hydrocarbons (Diesel) (Dry Weight)

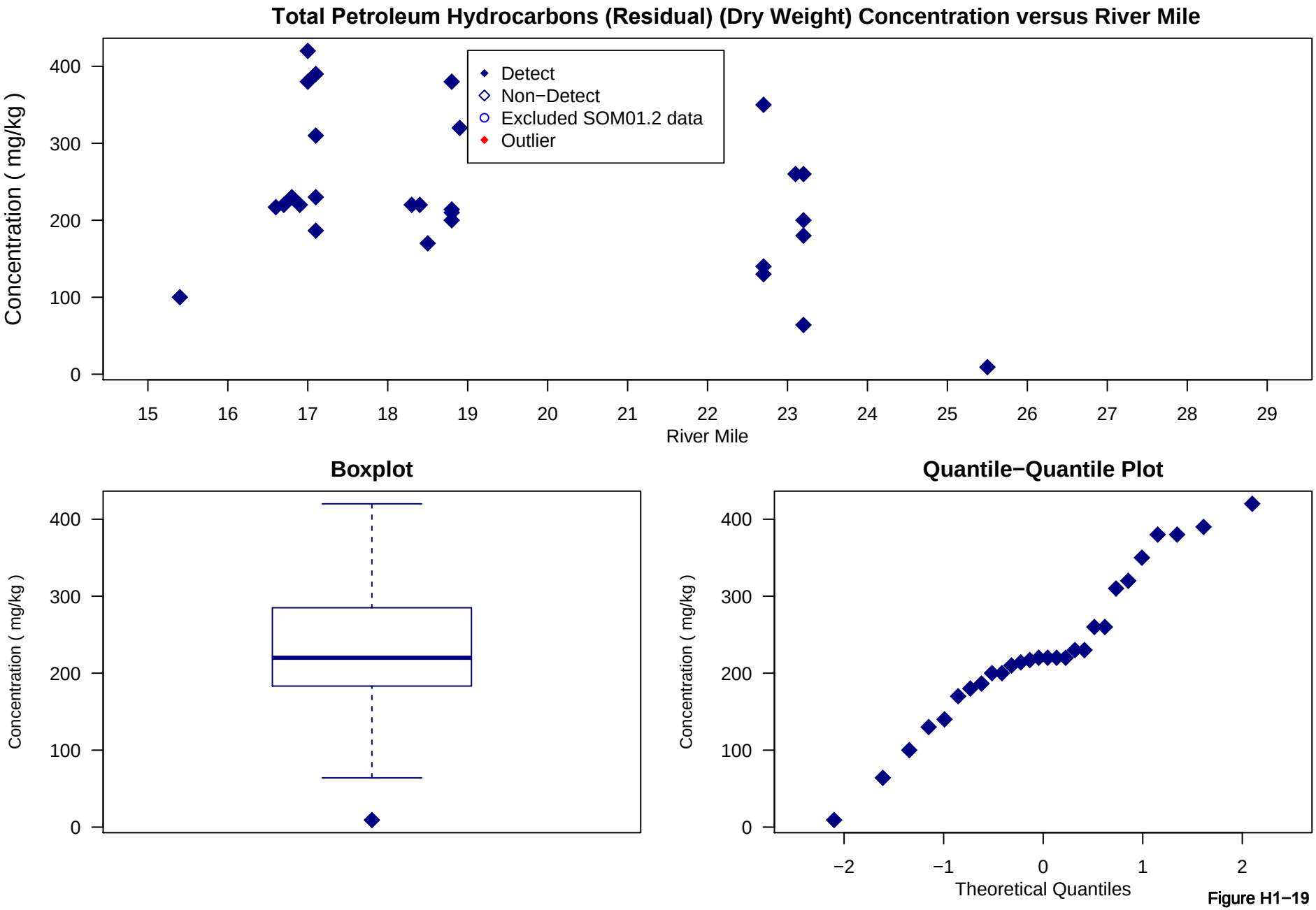

Figure H1−19
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Background Upriver Bedded Sediment Outlier Analysis
Total Petroleum Hydrocarbons (Residual) (Dry Weight)

Table H1-1. Upriver Surface Sediment Summary Statistics, Dry Weight Concentrations, All Data.

		Sample Counts					Data Summary			
							Non-detects		Detects	
Analyte	Units	High Biasing Non-detects	Sample Count	Detects	Non-detects	Detection Frequency (%)	Minimum	Maximum	Minimum	Maximum
Benzo(a)pyrene	µg/kg	0	71	42	29	59	0.33	21	0.53	53
Butylbenzyl phthalate [a]	µg/kg	1	69	15	51	23	2.2	45	2.7	33
Cadmium	mg/kg	0	67	58	9	87	0.04	0.11	0.04	0.3
cPAHs	µg/kg	0	71	59	12	83	0.39	10	0.66	76.99
Total DDD [b]	µg/kg	0	48	39	9	81	0.051	1.8	0.14	1.62
Total DDE [b]	µg/kg	0	48	47	1	98	0.12	1.8	0.11	2.45
Total DDT [a,b]	µg/kg	0	48	18	30	38	0.05	1.8	0.32	2.97
gamma-Hexachlorocyclohexane (Lindane)[a]	µg/kg	3	45	1	44	2	0.06	0.91	0.32	0.32
Hexachlorobenzene [c]	µg/kg	14	34	24	10	71	0.07	45	0.08	1.04
Total HPAHs	µg/kg	0	71	59	12	83	1	10	4.73	450
Lead	mg/kg	0	67	67	0	100	0	0	3.96	31.6
Total LPAHs	µg/kg	0	71	48	23	68	1.5	10	2.34	96
Naphthalene [a]	µg/kg	6	65	20	45	31	0.55	13	1.1	9.9
Nickel	mg/kg	0	67	67	0	100	0	0	12.3	29
Pentachlorophenol [a]	µg/kg	6	65	9	56	14	0.25	60	1.5	12
Phenanthrene	µg/kg	0	69	33	36	48	0.59	13	0.91	71
Total Petroleum Hydrocarbons	mg/kg	0	28	28	0	100	0	0	12	489
Total Petroleum Hydrocarbons (Diesel)	mg/kg	0	28	28	0	100	0	0	2.6	69
Total Petroleum Hydrocarbons (Residual)	mg/kg	0	28	28	0	100	0	0	9.2	420

Notes:

[a] Indicates data has a detection frequency of less than ~ 50%

[b] Indicates data analyzed by Method SOM01.2 were excluded

[c] Indicates only data analyzed by Method SW-8081A were used in calculating background values

cPAH - carcinogenic polycyclic aromatic hydrocarbon
DDD - dichlorodiphenyldichloroethane
DDE - dichlorodiphenyldichloroethylene
DDT - dichlorodiphenyltrichloroethane
HPAH - high-molecular-weight polycyclic aromatic hydrocarbon
LPAH - low-molecular-weight polycyclic aromatic hydrocarbon

Table H1-2. Summary of Background Results, Dry Weight and OC-Equivalent Concentrations.

		All Data							Outliers Removed							
			95% UPL			95% UCL				95% UPL			95% UCL			
Analyte	Units	Distribution	Type	UPL	UPL - OC Equivalent	Type	UCL	UCL - OC Equivalent	No. Outliers Removed	Type	UPL	UPL - OC Equivalent	Type	UCL	UCL - OC Equivalent	Notes:
Benzo(a)pyrene	µg/kg	Approx. Lognormal	Log ROS-t	19.4	29.8	Normal KM-t	7.34	11.3	5	Normal KM-t	9.97	15.4	Normal KM (% bootstrap)	4.73	7.3	Data are normal with outliers removed
Butylbenzyl phthalate	µg/kg	No background calculated, insufficient detections														
Cadmium	mg/kg	Gamma, Approx. Lognormal	Log KM-t	0.24	0.36	Gamma ROS	0.128	0.20	1	Normal KM-t	0.191	0.29	Normal KM-t	0.123	0.19	Data are normal with outlier removed
cPAHs	µg/kg	Lognormal	Log KM-t	38.5	59.3	Normal KM (BCA)	11.7	18.0	5	Normal KM-t	14.81	22.8	Normal KM-t	7.63	11.8	Data are normal with outliers removed
Total DDD [a]	µg/kg	Gamma, Lognormal	Hawkins-Wixley	1.8	2.8	Gamma ROS	0.8	1.2	0	Hawkins-Wixley	1.82	2.8	GROS Adjusted Gamma UCL	0.8	1.2	No outliers
Total DDE [a]	µg/kg	Approx. Normal, Gamma, Approx. Lognormal	Normal KM-t	1.9	2.9	Normal KM-t	1.1	1.7	0	Normal KM-t	1.89	2.9	Normal KM % bootstrap)	1.1	1.7	No outliers
Total DDT [a]	µg/kg	No background calculated, insufficient detections														
gamma-Hexachlorocyclohexane (Lindane)	µg/kg	No background calculated, insufficient detections														
Hexachlorobenzene [b]	µg/kg	Lognormal	Log KM-t	0.79	1.22	Normal KM (BCA)	0.37	0.57	7	Normal KM-t	0.294	0.45	Normal KM-t	0.188	0.29	Data are normal with outliers removed
Total HPAHs	µg/kg	Gamma, Lognormal	Hawkins-Wixley	235.3	362.4	Gamma ROS	90.7	139.7	3	Normal KM-t	127.3	196.0	Normal KM (% bootstrap)	61.7	95.0	Data are normal with outliers removed
Lead	mg/kg	Nonparametric	None	15.7	24.2	Normal Modified-t	9.29	14.3	6	Normal-t	10.0	15.4	Normal Student's-t	7.69	11.8	Data are normal with outliers removed
Total LPAHs	µg/kg	Approx. Gamma, Approx. Lognormal	Hawkins-Wixley	33.7	52.0	Gamma ROS	15.5	23.8	1	Normal KM-t	23.8	36.6	Normal KM-t	11.6	17.8	Data are normal with outlier removed
Naphthalene	µg/kg	No background calculated, insufficient detections														
Nickel	mg/kg	Normal, Gamma, Approx. Lognormal	Normal-t	26.2	40.3	Normal Student's-t	21.4	32.9	0	Normal-t	26.2	40.3	Normal Student's-t	21.4	32.9	No outliers
Pentachlorophenol	µg/kg	No background calculated, insufficient detections														
Phenanthrene	µg/kg	Lognormal	Log KM-t	15.27	23.5158	Normal KM-t	6.417	9.882	2	Normal KM-t	8.808	13.564	Normal KM-t	4.093	6.30322	Data are normal with outliers removed
Total Petroleum Hydrocarbons	mg/kg	Approx. Normal	Normal-t	458.9	706.7	Normal Student's-t	300.5	462.8	0	Normal-t	458.9	706.7	Normal Student's-t	300.5	462.8	No outliers
Total Petroleum Hydrocarbons (Diesel)	mg/kg	Normal, Approx. Gamma	Normal-t	60.3	92.8	Normal Student's-t	39.4	60.7	0	Normal-t	60.3	92.8	Normal Student's-t	39.4	60.7	No outliers
Total Petroleum Hydrocarbons (Residual)	mg/kg	Approx. Normal	Normal-t	399.7	615.5	Normal Student's-t	261.2	402.2	0	Normal-t	399.7	615.5	Normal Student's-t	261.2	402.2	No outliers

Notes:

[a] Indicates data analyzed by Method SOM01.2 were excluded

[b] Indicates only data analyzed by Method SW-8081A were used in calculating background values

The OC-equivalent values were calculated by multiplying the dry weight values by the ratio of the Study Area average total organic carbon content (1.71%)* and the average total organic carbon content of the background data set (1.11%), i.e., 1.71/1.11 or 1.54.

* This Study Area average surface sediment TOC is based on the RI data set compiled through June 2008 for the 2009 Draft RI report. The Study Area average TOC surface sediment for all data compiled through July 2010 for this Final RI report is 1.79%.

cPAH - carcinogenic polycyclic aromatic hydrocarbon
HPAH - high-molecular-weight polycyclic aromatic hydrocarbon
HW - Hawkins Wixley
KM - Kaplan-Meier
LPAH - low-molecular-weight polycyclic aromatic hydrocarbon
OC - organic carbon
PAH - polycyclic aromatic hydrocarbon
ROS - regression on order statistics
UCL - upper confidence limit
UPL - upper prediction limit