

# Snapshot Day

May 3<sup>rd</sup>, 2014

## Final Report



**Central Coast Snapshot Day 2014  
was organized by:**

**The Monterey Bay Sanctuary Citizen Watershed  
Monitoring Network:**

Supporting citizen monitoring programs throughout the  
Monterey Bay National Marine Sanctuary.

(831) 647-4227

[www.montereybay.noaa.gov](http://www.montereybay.noaa.gov)

**The Coastal Watershed Council**

A public education non-profit advocating the preservation  
and protection of coastal watersheds through the  
establishment of community-based stewardship programs.

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**The Monterey Bay National Marine Sanctuary  
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## **Executive Summary**

Since Earth Day 2000, volunteers have assembled on a Saturday morning in spring each year to collect water quality data from the water bodies entering the Monterey Bay National Marine Sanctuary (MBNMS). Snapshot Day (SSD) has become an annual event that has created partnerships, drawn over 2000 volunteers to date, and has helped foster an ethic of watershed stewardship for local citizens. The fourteen years of data collected by volunteers has become a valuable source of water quality data for the region.

SSD is organized by the Monterey Bay National Marine Sanctuary's Citizen Watershed Monitoring Network.

This year, volunteers gathered on the morning of May 3<sup>rd</sup> at one of four hubs located in the four counties bordering the Sanctuary (San Mateo, Santa Cruz, Monterey, and San Luis Obispo). At the hubs, volunteers picked up sample equipment and containers, received last minute instructions, and met fellow team members.

In 2014, 133 citizens volunteered between four and six hours of their time to monitor 112 sites. This year, 31% of the sites with flowing water met all of the water quality objectives (WQO) that were measured, indicating vibrant healthy water bodies.

Results reveal that dissolved oxygen is the most common **field** measurement to exceed the WQO and *E. coli* was the most common **lab** measurement to exceed the WQOs. Dissolved oxygen exceeded the WQO at 36% of the sites in 2014, as compared to 28% of sites in 2013, 19% in 2012 and 22% of sites in 2011. *E. coli* exceeded the WQO at 31% of the sites in 2014, as compared to 29% of sites in 2013, 20% in 2012 and 2011; nitrate exceeded the WQO at 16% of the sites in 2014, up from 11% of sites in 2013, 13% in 2012 and 14% in 2011. This year, orthophosphate had an exceedance rate of 9%, which is down from 11% in 2013, 13% in 2012, 12% in 2011 and overall down from 27% in 2010.

There were fourteen Areas of Concern (sites that exceeded three or more WQOs) identified this year, compared to 16 in 2013, 18 in 2012 and 2011 each, and 2010 when there were twenty-four sites. The Areas of Concern spanned only ten water bodies: Montara Creek (San Mateo County), Merced Street Storm Drain (Santa Cruz County), Watsonville Slough (Santa Cruz County), Struve Slough (Santa Cruz County), Moro Cojo Slough (Monterey County), Alisal Slough (Monterey County), Santa Rita Creek (Monterey County), Tembladero Slough (Monterey County), Lower Salinas River (Monterey County) and the Salinas Reclamation Ditch (Monterey County).

Fifteen years of data gathered by trained SSD volunteers is used to help resource managers focus attention on areas that need it the most. Programs such as SSD are an important link for residents to their local waterways and actions to help improve water quality. SSD data are also used to inform public policy through incorporation into the 303(d) listing of impaired water bodies by the Central Coast Regional Water Quality Control Board.

We would like to thank our volunteers and all of our partners for making this event a success.

## Methods

Each year, trainings are conducted in all four counties bordering the sanctuary. Trainings cover the Snapshot Day (SSD) program and history, how to take field measurements, and how to collect lab samples. Many volunteers have never taken field measurements or collected water samples before, so the training is important in developing the skills necessary to proficiently participate.

During the SSD event, volunteers take field measurements for air and water temperature, dissolved oxygen, conductivity, pH, and transparency or turbidity. Grab samples are also collected for lab analysis of bacteria (*E. coli*) and nutrients (nitrate as N, phosphate as P). Each monitoring team is equipped with a bucket “kit” that includes thermometer(s), a CHEMets dissolved oxygen kit, an Oakton conductivity meter, Machery-Nagel non-bleeding pH strips, and a transparency tube or turbidity kit. The kits also include distilled water, gloves, paper towels, a trash bag, pencils, sample bottles, and a clipboard with data sheets, instructions, and maps with direction to each site. Each team monitors two or more sites. In one case, one team monitors 9 sites covering over 25 miles of the southern Big Sur coastline.

All monitoring results are compared with water quality objectives (WQOs) designated by the Central Coast Ambient Monitoring Program (CCAMP), the California Basin Plan, or the US Environmental Protection Agency (see Table 1). For this event a state approved Quality Assurance Project Plan and Monitoring Plan (QAPP) is followed.



**Measuring the transparency at Tembladero Sough in Monterey County.**



**Checking transparency at Deer Creek in San Mateo County.**

**Figure 1. Map of Snapshot Day 2014 monitoring sites**

**Table 1: Water Quality Objectives**

<b>Parameter (reporting units)</b>	<b>Water Quality Objectives</b>	<b>Source of Objective</b>
Dissolved Oxygen (mg/L)	Not lower than 7 or greater than 12	California Basin Plan Objective
<i>E. coli</i> (MPN/100ml)	Not to exceed 235 <sup>1</sup>	EPA Ambient Water Quality Criteria
Nitrate as N (ppm)	Not to exceed 2.25 <sup>2</sup>	Central Coast Ambient Monitoring Program (CCAMP)
Orthophosphate as P (ppm)	Not to exceed 0.12 <sup>3</sup>	Central Coast Ambient Monitoring Program (CCAMP)
pH	Not lower than 6.5 or greater than 8.5	California Basin Plan Objective
Transparency (cm)	Not less than 25	Central Coast Ambient Monitoring Program (CCAMP)
Turbidity (NTU)	Not to exceed 25	Central Coast Ambient Monitoring Program (CCAMP)
Water Temperature (°C)	Not more than 21 <sup>4</sup>	Central Coast Ambient Monitoring Program (CCAMP)

<sup>1</sup> Environmental Protection Agency, Updated WQO.

<sup>2</sup> Central Coast Ambient Monitoring Program, Pajaro River Watershed Characterization Report 1998, rev 2003.

<sup>3</sup> Williamson, The Establishment of Nutrient Objectives, Sources, Impacts and Best Management Practices for the Pajaro River and Llagas Creek, 1994.

<sup>4</sup> Moyle, P. 1976. Inland Fisheries of California. University of California Press.

## Results

On May 3<sup>rd</sup> 2014, 133 volunteers gathered at four hubs across the central California coastline. From those four hub the volunteers spread out to monitor 112 sites along creeks and rivers that flow into the Monterey Bay National Marine Sanctuary (MBNMS) (Figure 1). This year, 31% of sites met the water quality objectives for all lab and field parameters.

### Water Temperature

Just as temperature on land impacts terrestrial plants and animals, the temperature of the water can affect the life and health of aquatic organisms. Many fish species and other aquatic life need specific temperatures within which to survive and reproduce. Water temperature can also affect the amount of dissolved oxygen: increasing temperature causes a decrease in dissolved oxygen. Slowing water flow or removing streamside vegetation which provides shade can also cause water temperatures to rise to undesirable levels that can harm aquatic life. SSD data is collected during the morning hours, so temperatures do not necessarily reflect the daily maximum temperatures for the water body.

The Basin Plan Objective sets the upper limit of water temperatures at 21 degrees Celsius (°C). Temperatures above 21°C can harm cold water fish such as salmon and steelhead, as well as other aquatic organisms. Eleven sites (12%) exceeded the WQO for water temperature this year. The highest result was 24.8 °C in Santa Rita Creek at Van Buren Avenue (Monterey County).

### Dissolved Oxygen

Aquatic organisms rely on sufficient amounts of dissolved oxygen to perform regular behaviors like feeding, spawning, and incubating. Excessive nutrients in water can cause an increase in plant growth, which uses up oxygen in the water. Additionally once the plants die, decomposition further depletes the oxygen available to aquatic organisms.

Although the California Basin Plan Objective for dissolved oxygen is not less than 5 milligrams per liter (mg/l), we use the WQO for Cold Water Fish, which is not less than 7 mg/l or greater than 12 mg/l. These numbers are based on the amount of dissolved oxygen needed by migrating steelhead.

This year, thirty-four (36%) of the sites exceeded the WQO for dissolved oxygen. Of those that exceeded the WQO, all but one was below the WQO, indicating an oxygen-deprived environment. The lowest dissolved oxygen result was in Struve Slough at Harkins Slough Road (Santa Cruz County) with a result of 1.5 mg/L.

### pH

pH is a measure of the percent of hydrogen ions in water. A value of 7 is neutral, above 9 is alkaline (or basic) and below 5 is acidic. Many aquatic organisms require a very specific range

of pH to carry out necessary chemical and biological reactions. Extremely low or high pH levels can harm fish gills and fins.

The California Basin Plan Objective for pH is between 6.5 and 8.5. In 2013, four (4%) of the sites did not meet the WQO. The lowest pH result of 5.5 was from two sites in Montara Creek (San Mateo County).

## **Transparency/Turbidity**

Transparency and turbidity are a measure of the amount of suspended solids in a liquid. Normal transparency/turbidity measurements vary for different water bodies, but in general, low transparency or high turbidity levels can indicate problems such as erosion, nutrient loading, or extraordinary algae growth. While transparency and turbidity are describing similar characteristics, the way in which they are measured is different. Transparency measures the ability to see a secchi disk through a column of water. CCAMP's Action Level for transparency not less than 25 centimeters. Transparency was measured at 92 sites with 15 (16%) not meeting the Action Level for transparency. The lowest transparency measurement of 4.4 cm was taken in Santa Rita Creek at Van Buren (Monterey County).

Turbidity is determined using a turbidity meter that measures the amount of light that can penetrate a sample tube of water. CCAMP's Action Level for turbidity is not greater than 25 Nephelometric Turbidity Units (NTU's). Turbidity was measured at 4 sites, none exceeded the water quality objective. At these same four sites transparency was also measured, and not exceeded.

Two sites did not have transparency or turbidity measurements taken, no explanation was given by the volunteers.

## **Nutrients**

Nitrate (as N) and orthophosphate (as P) are measured for SSD. While these nutrients are naturally occurring in streams and rivers, other sources can come from fertilizers, pesticides, detergents, animal waste, sewage, or industrial wastes. Heightened levels of nutrients can lead to excessive algal or aquatic plant growth, which ultimately depletes the amount of oxygen available in the waterway.

### **Nitrate**

Fifteen of the sites (16%) exceeded the CCAMP Action Level of 2.25 mg-N/l for nitrate as N (Figure 2). The highest result for nitrate as N was 49.6 mg-N/L in Tembladero Slough at Molera Road (Monterey County). A total of 44 sites (47%) had non-detectable levels of nitrate.

### **Orthophosphate**

Eight sites (9%) exceeded the CCAMP Action Level of 0.12 mg/l for orthophosphate-P. The highest concentration of orthophosphate was in Struve Slough at Lee Road (Santa



Cruz County) with a concentration of 0.6 mg-P/L. A total of 82 sites (87%) had non-detectable levels of orthophosphate (Figure 3).

## Bacteria

### *E. coli*

Coliform bacteria generally originate from the feces of warm blooded animals such as humans (from sewage) or wildlife. While coliform bacteria are usually not the cause of sickness, their presence can indicate that other illness causing pathogens are present. The EPA has set a WQO for *E. coli*, at 235 MPN/100ml. Twenty-nine sites (31%) exceeded the *E. coli* WQO on Snapshot Day 2014 (Figure 4). The highest result for *E. coli* was from San Vicente Creek at Cypress (San Mateo County) with a result of 24,196 MPN/100 ml (Figure 8). Thirty-eight sites (40%) had results less than 100 MPN/ 100 ml.



Snapshot Day volunteers are one of a kind!

**Figure 2. Nitrate as N Results for Snapshot Day 2014.**

**Figure 3. Orthophosphate-P Results for Snapshot Day 2014.**

**Figure 4. *E. coli* Results for Snapshot Day 2014.**

## Areas of Concern

When lab and/or field results for a single site exceed three or more water quality objectives, the site is designated an Area of Concern (AoC). Over the past several years, a trend has emerged of more than one AoC per water body. For example, the Tembladero and Moro Cojo Slough have more than one site that is an AoC along the same waterway. For this reason we have chosen to display the AoC data two ways: by water body (Figure 5) and by site (Figure 6).

In 2014, fourteen sites (15%) were designated Areas of Concern on ten water bodies (Figure 5). For the most part, AoC are designated and stay on the list for many years. This year Montara Creek is on the list for the first time due to exceedances at two sites for dissolved oxygen, pH and transparency (Figure 6). The Lower Salinas River is back on the AoC list again after a one year break. The Lower Salinas River site had exceedances in dissolved oxygen, temperature and nitrate as N. All data is available in Appendix 1.

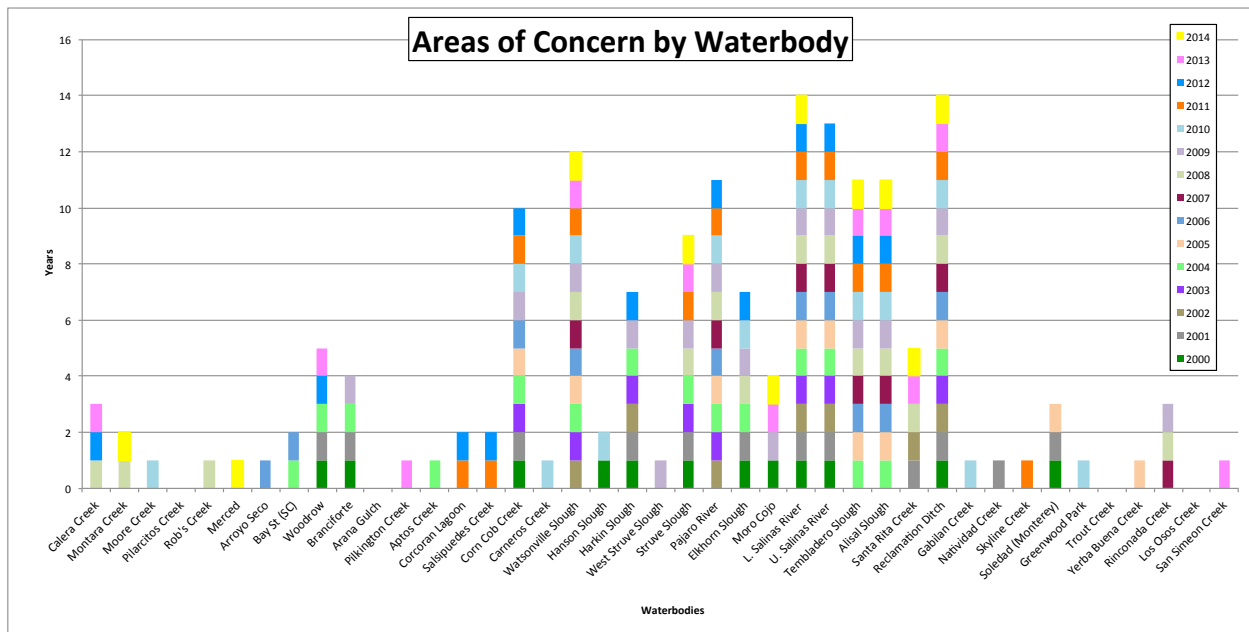


Figure 5. Areas of Concern by water body 2000-2014.

**Figure 6. Areas of Concern for Snapshot Day 2014.**

## Conclusion

In its fifteenth year, Snapshot Day 2014 brought together 133 committed citizens to monitor the water quality of 112 different sites along creeks and rivers draining into the MBNMS. Many of the sites monitored (31%) had no exceedances for any parameter and provided good conditions for cold-water fish, one beneficial use by which Snapshot Day data is compared.

The number of Areas of Concern (sites with three or more exceedances) has continued to drop since 2009. With fourteen Areas of Concern, 2014 continues the downward trend in the total number of Areas of Concern. Even with fewer Areas of Concern this year, Snapshot Day sites at the bottom of large rivers or creeks that have urban areas and agricultural influences show the most significant problems in regards to nutrients, bacteria, and dissolved oxygen. In comparison creeks and rivers on the San Mateo County and Big Sur coast have few to no exceedances. Of the fourteen Areas of Concern on ten water bodies, nine of those water bodies are listed on the 303(d) list for impaired waterways by the Regional Water Quality Control Board. Those waterbodies are: Struve Slough, Watsonville Slough, Alisal Slough, Moro Cojo Slough, Tembladero Slough, Salinas Reclamation Ditch, and Santa Rita Creek. The 303(d) list was created to identify impaired state waterways. The methodology for this listing can be found at the State Board web site, [www.swrcb.ca.gov](http://www.swrcb.ca.gov).

Snapshot Day 2014 results reveal a decrease in nitrate concentration while *E. coli* is still a problem at many sites and needs to be addressed. Additionally dissolved oxygen and *E. coli* continue to be issues at many sites. At each site trash is a recurring problem. Efforts focused on both urban and agricultural management measures to control nitrate, *E. coli* and conditions that impact dissolved oxygen levels, it is our hope that we will continue to see improvements in water quality.

Once more, the Network would like to thank all of the volunteers who made this event possible. A monitoring effort of this magnitude could only be completed by a large group of dedicated volunteers. The data generated by volunteers is a valuable resource for identifying long-term trends in central California coastal water bodies. Snapshot Day is a successful annual event due in large part to continued interest and support by volunteers and partner organizations.



**The Frenchman's Creek team heads in San Mateo County.**

**Appendix 1: 2014 Results by County/Station**



Site Tag	Dissolved Oxygen mg/L	pH	Transparency cm	Water Temperature °C	Turbidity NTU	E. coli MPN/ 100ml	NO3-N mg-N/ L	PO4-P mg-P/L
202-ALPIN-11	8.0	7.75	>120	20.7		563	0.24	0.2
202-BEARG-11	6.0	6.8	120.0	13.1		<10	<0.11	ND
202-BUTAN-11	2.0	6.5	65.0	13.7		52	0.25	ND
202-CALER-11	5.0	7.0	120.0	13.2		20	0.16	ND
202-CALER-12	5.5	7.5	120.0	14.5		135	1.74	0.2
202-DEERC-12	8.0	7.5	104.0	13.2		3654	<0.11	ND
202-DENNI-11	7.5	6.5	120.0	13.2		86	0.28	ND
202-FRENC-11	12.0	7.5	83.0	13.8		201	0.19	ND
202-GAZOS-11	8.0	7.0	>120	15.0		52	<0.11	ND
202-GAZOS-15	6.0	6.5	>120	13.2		31	<0.11	ND
202-LAHON-11	7.0	6.8	>120	12.6		86	<0.11	ND
202-LOBIT-11	10.0	7.0	>120	12.3		63	0.36	ND
202-MARTI-11	9.0	6.3	80.0	12.5		98	<0.11	ND
202-MILLC-11	8.0	7.5	NR	12.8		31	0.14	ND
202-MONTA-11	4.0	5.5	19.0	12.5		122	<0.11	ND
202-MONTA-12	4.5	5.5	23.0	12.5		216	<0.11	ND
202-PESCA-11	5.0	7.0	>120	14.8		63	0.26	ND
202-PILAR-11	8.0	7.0	120.0	13.6		428	0.54	ND
202-POMPO-11	5.0	6.5	35.2	16.9		10	<0.11	0.1
202-PURIS-11	10.0	7.0	94.3	12.7		173	0.21	ND
202-SANGR-11	12.0	7.0	44.0	19.5		160	<0.11	ND
202-SANGR-12	4.0	7.0	>120	13.9		85	<0.11	ND
202-SANGR-14	8.0	7.0	>120	11.6		41	<0.11	ND
202-SANPE-11	8.0	7.5	120.0	13.9		576	0.4	ND
202-SANPE-12	6.5	7.0	120.0	12.5		109	0.15	ND
202-SANPE-13	8.0	7.5	120.0	14.2		663	0.35	ND
202-SANVI-11	7.0	6.0	120.0	13.3		24196	0.49	ND
202-TUNIT-11	8.0	6.5	>120	12.7		<10	<0.11	ND
202-WHITE-12	8.0	6.5	>120	14.3		75	<0.11	ND
304-APTOS-23	6	6.5	120.0	16.9		100	ND	ND
304-ARANA-21	7	7.0	120.0	13.1		750	0.3	0.1
304-ARANA-22	6	7.5	13.0	16.2		100	0.2	ND
304-ARROY-21	4	7.0	120.0	14.5		17	ND	ND

Site Tag	Dissolved Oxygen mg/L	pH	Transparency cm	Water Temperature °C	Turbidity NTU	E. coli MPN/ 100ml	NO3-N mg-N/ L	PO4-P mg-P/L
304-ARROY-22	5	7.0	120.0	16.6		<100	0.6	ND
304-ARROY-23	12	7.0	72.0	17.1		520	1	ND
304-BRANC-23	7	7.5	120.0	13.8		310	0.4	ND
304-CARBO-21	6	7.0	120.0	13.7		200	0.6	ND
304-LEONA-21	4	7.0	98.0	13.6		<100	0.2	ND
304-LIDEL-21	8	6.5	>120	11.7		5	0.3	ND
304-MOORE-21	5	7.5	>120	19.8		<100	ND	ND
304-MOORE-24	4.5	7.0	63.6	13.1		960	ND	ND
304-MOORE-26	11	8.0	53.0	22.3		1320	ND	ND
304-NEWYE-21	5.5	7.0	120.0	12.7		41	0.8	ND
304-PILKI-21	6	7.5	62.0	14.6		630	0.1	ND
304-PILKI-22	4	7.5	74.0	13.9		630	0.2	ND
304-SANLO-21	7	7.5	120.0	15.8		630	0.2	ND
304-SANLO-22	8	7.7	>120	19.9		310	0.1	ND
304-SANLO-26	9.77	7.5	>120	17.6	1.97	310	0.4	ND
304-SANLO-27	8.95	7.5	>120	14.3	1.61	59	0.4	ND
304-SCOTT-22	9	6.75	>120	12.8		4	ND	ND
304-SCOTT-25	8	6.5	>120	14.2		100	ND	ND
304-SCSD-02	4	7.0	>120	17.6		7230	3.9	ND
304-SCSD-04	8	7.0	>120	16.5		200	3	ND
304-SOQUE-22	8	7.0	120.0	15.8		100	ND	ND
304-WADDE-21	6	7.2	120.0	14.9		100	ND	ND
304-WADDE-22	7	7.0	120.0	13.9		100	0.1	ND
304-ZAYAN-21	9.81	7.25	>120	14.9	1.71	310	0.5	0.1
304-ZAYAN-22	9.17	7.5	78.0	14.7	2.26	100	0.2	ND
305-BEACH-21	8.0	7.3	37.8	19.0		100	20.6	ND
305-HARKI-21	7.0	7.7	8.8	21.3		100	ND	ND
305-PAJAR-21	10.0	8.3	57.2	19.5		<100	3.3	ND
305-STRUV-21	1.5	6.3	83.1	18.3		100	ND	0.3
305-STRUV-22	2.5	6.5	13.5	22.1		<100	ND	0.6
305-WATSO-23	12.0	8.3	14.0	22.7		300	8.1	ND
306-ELKHO-34	11.0	7.5	>120	17.9		860	30.8	ND
306-MOROC-31	12.0	8.0	7.0	24.6		5040	4.9	0.5
306-MOROC-33	4.5	8.0	12.0	22.2		<100	ND	ND
307-CARME-33	9.0	6.5	>120	14.7		<100	ND	ND
307-CARME-35	7.0	6.5	>120	14.7		100	ND	ND
308-BIGSU-31	10	7.5	120.0	17.1		5	ND	ND

Site Tag	Dissolved Oxygen mg/L	pH	Transparency cm	Water Temperature °C	Turbidity NTU	E. coli MPN/ 100ml	NO3-N mg-N/ L	PO4-P mg-P/L
308-HOTSP-31	7	6.5	>120	14		3	ND	ND
308-LIMEK-31	9	6.75	>120	14.6		2	ND	ND
308-MCWAY-31	10	6.5	>120	14.7		100	ND	ND
308-PALOC-31	9	7.5	120.0	13.4		36	ND	ND
308-SYCAM-31	6	7.0	120.0	13.8		<1	ND	ND
308-SYCAM-32	7	7.0	120.0	14.2		45	ND	ND
309-ALISA-32	12.0	7.5	19.0	14.1		200	14.3	0.3
309-ASILO-31	2.5	6.5	120.0	15.4		11	0.4	ND
309-ATASC-41	7	7.0	NR	15.6		345	ND	ND
309-LIBRA-31	7.0	7.0	120.0	NR		100	0.2	ND
309-RECDI-31	11.0	8.3	16.2	22.4		750	3	ND
309-SALIN-31	>12	8.3	>120	21.5		100	40	ND
309-SALIN-32	11.0	7.3	20.0	20.4		<100	23.9	ND
309-SALIN-45	6.0	7.0	55.2	17.3		52	ND	ND
309-SMARG-41	5.5	7.5	120.0	16.0		512	ND	ND
309-SRITA-35	11.0	7.5	4.4	24.8		5560	3.7	ND
309-TEMBL-31	8.0	7.0	12.2	21.8		100	49.6	0.2
309-TEMBL-32	9.0	7.0	14.2	18.0		200	47.8	ND
309-TEMBL-33	8.0	7.0	14.0	20.9		750	40.2	0.2
309-TROUT-41	9.0	6.5	120.0	12.5		512	ND	0.1
310-CARPO-41	3.5	7.0	>120	13.7		<10	ND	ND
310-LAGUN-41	8.0	8.0	27.0	22.1		865	ND	ND
310-SANTA-41	4.0	7.0	>120	16.0		253	ND	ND
310-SANTA-42	8.0	7.0	>120	13.8		110	ND	ND

**ND= Non detect; NR= Not recorded.**