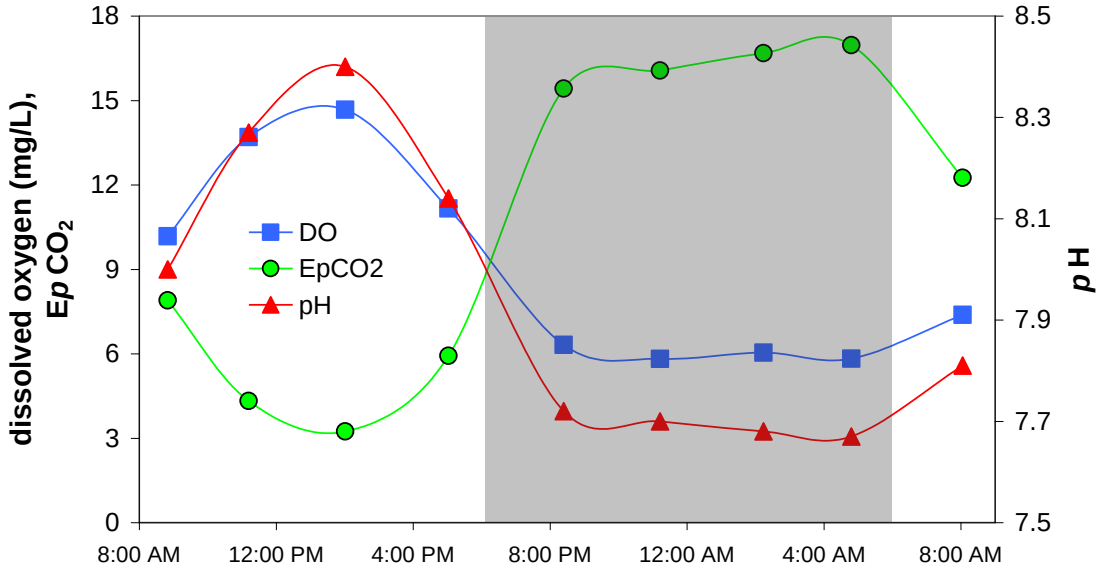
While You Were Sleeping . . .

Sampling a stream to determine its condition is akin to visiting a doctor for an annual checkup, albeit at more frequent intervals: measurements are made and samples sent to the laboratory. Any change is usually assumed to have occurred slowly, day by day. And were we to sample once a day, at approximately the same time, we would probably see the gradual changes taking place. The key phrase, however, is "at approximately the same time." During the dry season, when flows are low and plants and algae present, changes that take place *during a day* are far more drastic and meaningful than any we are likely to see day-to-day or month-to-month.

The chart shows sampling results from last September 10-11 at Foster Park on the Ventura River, but could as easily be from any local, algae choked, creek. Samples and measurements collected during this 24 hour period provide a look at daily (diel or diurnal) changes – think of it as a checkup every 3 hours when flow was low and the river bottom covered with vibrant green algae. On the chart light areas mark daylight, the grey, nighttime. The amount of oxygen dissolved in the water (DO, measured in parts-per-million or milligrams per liter) changed from a high of 15 mg/L in the early afternoon to a low near 5 at night. The change in acidity (*p*H) follows the change in DO: from a high of 8.4 to a low of 7.6. E*p*CO_2 is the ratio of measured CO_2 to what we would normally find dissolved in water of the same temperature. CO_2 varied in opposition to DO and *p*H, from 3-times the normal (or equilibrium) concentration during the day to 17-times greater at night.

All these changes are caused by algae, photosynthetic organisms that use sunlight to remove carbon dioxide from the water and convert it into biomass. During photosynthesis they generate oxygen. In other words, during daylight algae increase dissolved oxygen and decrease CO_2. At night, algae respire, just like us, removing oxygen and increasing CO_2. The lower chart indicates that along with carbon dioxide they are also removing nutrients as they build cell tissue – producing a swing in nitrate concentrations that matches the variation in CO_2. Cleaning the stream is one way to look at it, and like most of us, for them it's a day job.

So what? Well, it means we need get up before daylight if we want to really monitor stream health. Minimum oxygen and pH occur just before dawn, when the sun is shining we see only the other extreme. The Regional Water Quality Control Board has set standards to insure reasonable conditions for aquatic life: pH no lower than 7, no higher than 8.5 (the difference between pure water and sea water); dissolved oxygen no lower than 5 mg/L – the limit shown by the dashed line in the lower chart (below 5, a steelhead or trout would be desperately seeking a snorkel). On this night *p*H was not a problem, its variation well within limits, but dissolved oxygen approached the minimum. As to what happens on other nights, or in other streams, we don't have a clue.


dissolved oxygen (mg/L),
Ep CO2
pH
DO
EpCO2
pH
18
15
12
9
6
3
0
8.5
8.3
8.1
7.9
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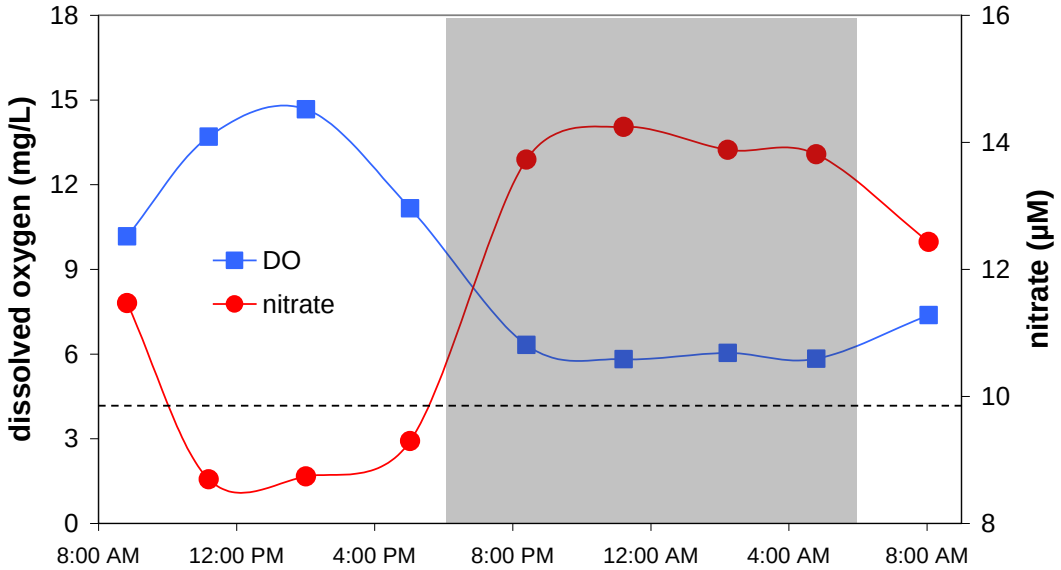
dissolved oxygen (mg/L)
nitrate (µM)
DO
nitrate
18
15
12
9
6
3
0
16
14
12
10
8
8:00 AM
12:00 PM
4:00 PM
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