On Tuesday, July 15th, Ben and I re-visited most of the Ventura locations included in the UCSB-TMDL project to check on their algal status, and to brainstorm various ideas about algal growth in this watershed. Along with photos of current conditions, I've included pictures of things that struck me as particularly interesting or noteworthy in the figures that follow.

Aside from increased amounts of spirogyra accumulating in pools, there doesn't appear to be much change at the upper sites (VR12.9, 14 & 15). I find the algal transitions in the pool just upstream of the N. Fork Bridge at VR14 interesting and I've included photos of these changes, (1) from relatively dense cladophora to (2) cladophora dying to (3) spirogyra coming in on top of dead clado and (4) its further increase, in Figure 1. As mentioned in Figure 2, the green color of many upper-watershed pools is intriguing and I wonder if measuring water-column chl-a at some of these places might not be of value. Other than planktonic algae, no plausible reason for this color comes to mind – especially in areas where there was no green macro-algae or bright surrounding vegetation to fool the eye. Aside from spirogyra in pools, almost all other, still active, filamentous algae is restricted to areas of fast-moving current – nicely keeping with the nutrient supply hypothesis expounded in earlier reports. We did find spirogyra growing in a fast moving stretch of water on the downstream edge of the Camino Cielo ford (VR12.9) (Figure 3). This was almost the only exception to the spirogyra/slow water (pool) connection. What the noticeably paler color of this algae – especially when compared with darker spiro growing nearby – might connote, I haven't a clue. But I note that it resembles the earlier cladophora in color. It might be interesting to collect some algal samples and compare nutrient content (perhaps the pale color of upper-water shed cladophora, when compared with down-river sites, also indicated a nutrient difference).

Algae at VR06.3, just above the San Antonio confluence, was fading, but still active. This is in contrast with the dead cladophora found everywhere in the main channel below the Ojai Sewage Treatment Plant (Figure 4). In these reaches, diatoms have colonized the dead clado and dominate the river bottom, giving the water a decidedly dark-brown cast (Figure 5, see also 4 & 6). The interesting question is why? Was it simply time for cladophora on the lower river to go? And if so, why is it still going reasonably strong at the San Antonio confluence (and at Foster Park), i.e., above the treatment plant? Julie and I saw something like this back in 2003 – cladophora still highly productive at Foster Park, dead at Shell Road – and speculated on the possibility of some deleterious substance in treatment plant outflow killing off cladophora, but presenting far less of a detriment to diatoms. We decided then that it would be impossible to prove, but that this phenomena is occurring when treatment plant outflows are increasingly dominating lower-river flow is suggestive (treatment plant outflows now provide about 35 % of total lower-river flow compared with 17 % on June 17th).

Also suggestive are patches of still active cladophora found at edges of the main channel. Figure 7 (and the upper photo in Figure 6) shows some of this. These areas are characterized by very low or stagnant flows, often trickles that first flow over soil (as is the case in both Figure 7 photos). As in 2003, there is no way to prove, or disprove, this possibility since it may have as easily been caused by some discrete event in the past as by some ever present effluent constituent.

Be that as it may, dead cladophora on the lower river does not mean an end to the algal problem in these reaches. The June pre-dawn/mid-afternoon sampling report mentioned my surprise at the relatively low increase in mid-afternoon DO at VR06.3 (10.6 mg/L vs. 15.1 at VR03.5), but

Figure 1. VR14, looking upstream from the bridge at the pool by the abutment.

measurements on July 15th showed that this was neither an aberration nor error. Dissolved oxygen at VR03.5 (at 13:30) was 9.6 mg/L, 15.0 mg/L at VR03.5 (at 14:30), reasonably similar to concentrations measured the previous month. I regard the very high reading at VR03.5 as indicating a rather impressive diatom performance, especially since DO should be continually depressed by the appreciable decay taking place at this reach. However, now that the VR06.3 mid-afternoon DO readings appear accurate, the question of why the DO peak is so low, given the visual presence of lots-of-algae, remains. It's possible that the surfacing groundwater furnishing flow to this location (the next site, VR11, 2.5 km upstream is bone dry) is low in oxygen, but this should affect both maximum and minimum readings and not the magnitude of the depression. It is also possible that flow here is considerably higher than at Foster Park, or below the sewage treatment plant, i.e., that the impact of algae at VR06.3 is reduced because of greater water volumes. Ojai and Ventura withdraw water from beneath the river just upstream of Foster Park – about 3 km downstream from the San Antonio confluence. Channelkeeper has never measured flow at VR06.3, but it seems like a half-day spent measuring flow here, and comparing it with flow measured at VR06, would be a pretty good idea.

Water-level in the lagoon is up slightly. Soon after its collapse on June 4th, and the subsequent draining of the lagoon, tidal flows re-established the sand-berm. In the month and a half that followed it appears to have become increasingly substantial and stable. And water levels have continued to rise. This is visible in Figure 8 if you look very hard, but Figure 9, showing the effect on an island adjacent to the RR Bridge, better indicates this steady rise. Since the first week in June, lagoon water has been completely fresh; its conductivity is only slightly higher than that of river water measured at Main Street. Reasons for the relatively slow rise in level (much slower than observed in May) would appear to be reduced lower-river flows and increased evapotranpiration (flow at Foster Park on July 15th was 7 cfs, down from 18 cfs on June 17th; the treatment plant adds about 3.7 cfs, i.e., flow into the lagoon is down more than 50 %). However, the massive amounts of filamentous macro-algae seen before the sand-berm collapse have not reappeared. Phytoplankton continue to dominate primary production in the lagoon.

Finally, Figure 10 shows a photo of VR07 (lower San Antonio Creek, it's actually a photo of Kristi's study reach, located below the Channelkeeper site) and one taken from the Main Street Bridge (VR01) of flow immediately downstream. I found the extravagant growth of dense, tall weeds along the south bank of San Antonio interesting – the bank was quite bare on May 16th. I wish my garden would give an equal performance. Lots of algae were still present – all enteromorpha.

The Main Street photo shows appreciable sediment being carried by the flow. This sediment almost certainly originates in agricultural land grading operations taking place on the west bank upstream. This situation has persisted at least since June 7th, and may have also been captured in photos on May 3rd. The Basin Plan has no hard and fast sediment limits, simply stating "waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses." We should carefully monitor turbidity readings taken at this location with an eye on possible fishery impacts. A walk upstream, to identify actual sources of this sediment, would be another good idea.

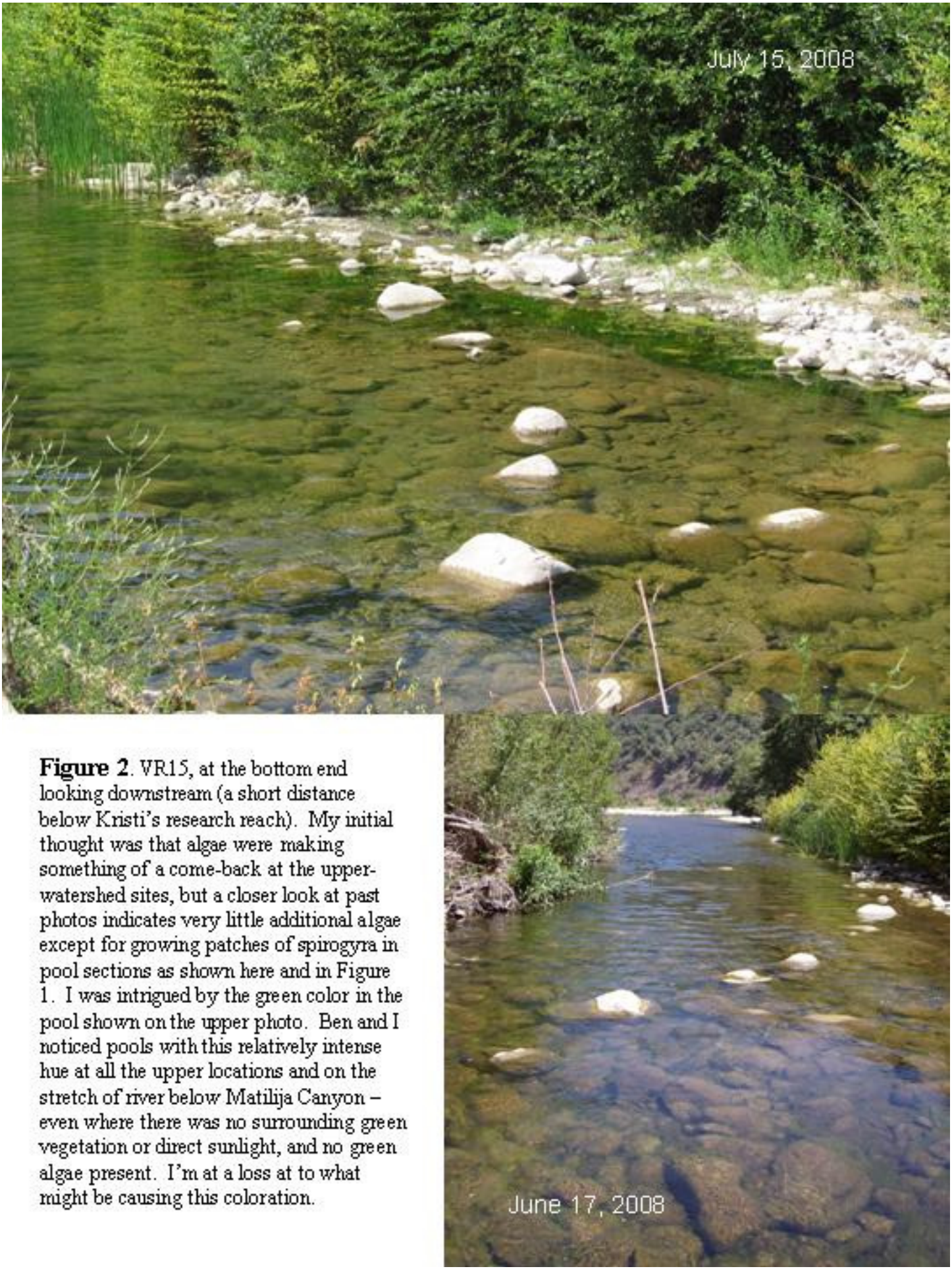

Figure 2. VR15, at the bottom end looking downstream (a short distance below Kristi's research reach). My initial thought was that algae were making something of a come-back at the upper-watershed sites, but a closer look at past photos indicates very little additional algae except for growing patches of spirogyra in pool sections as shown here and in Figure 1. I was intrigued by the green color in the pool shown on the upper photo. Ben and I noticed pools with this relatively intense hue at all the upper locations and on the stretch of river below Matilija Canyon – even where there was no surrounding green vegetation or direct sunlight, and no green algae present. I'm at a loss at to what might be causing this coloration.

Figure 3. VR12.9: The pale green color of the cladophora struck me back in April. The cladophora, long dead, is now topped, in this section of rapid flow, with new spirogyra – also pale green. Meanwhile, side-channel spirogyra (in foreground of upper left photo) was dark green then and is still dark green.

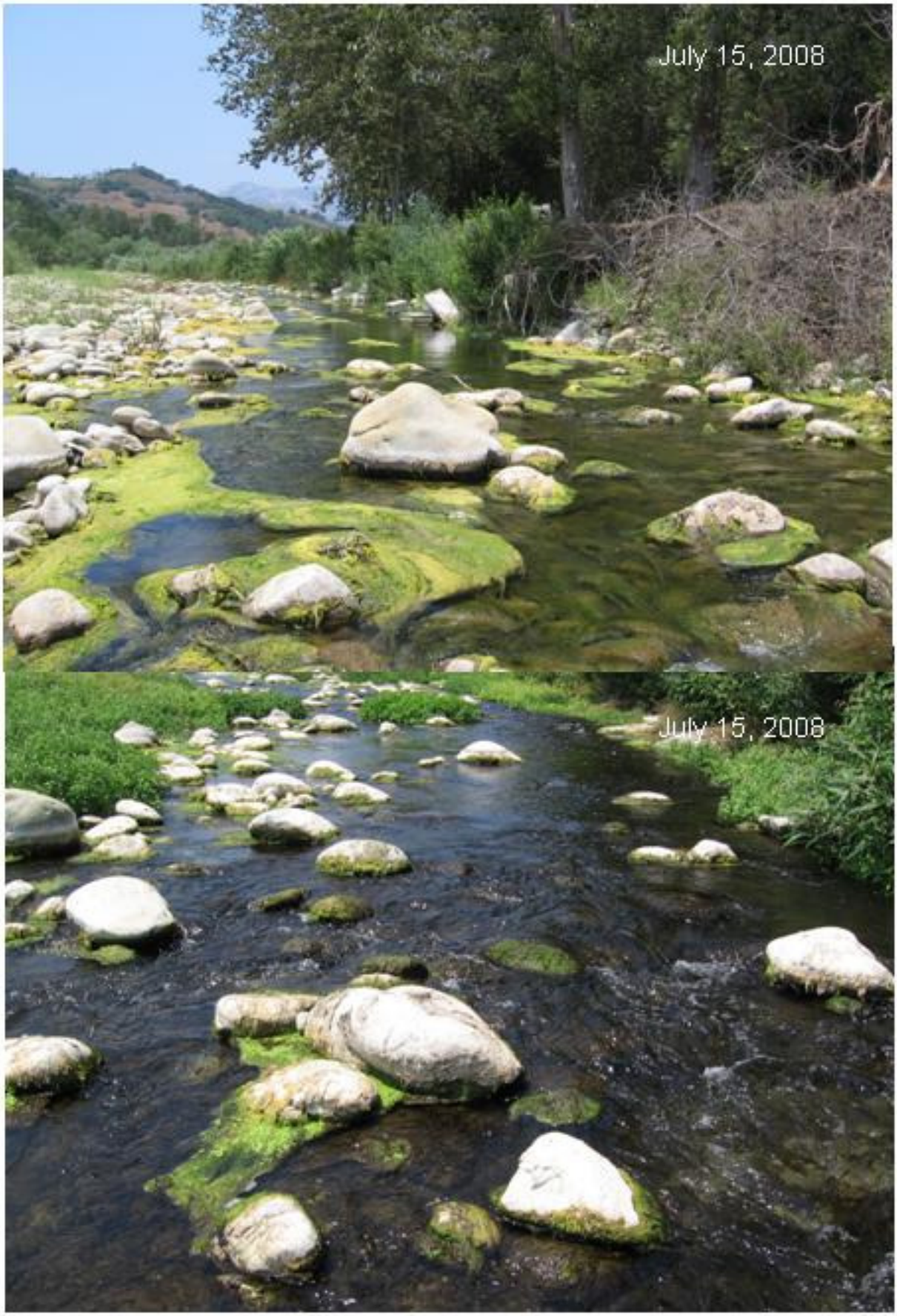

Figure 4. (top) VR06.3, the Ventura River just above the San Antonio confluence. (bottom) VR03.5, just above the Canada Larga confluence (and below the Ojai Sewage Treatment Plant.

Figure 5. Algal close-ups, July 15, 2008: (top) VR06.3 (just above the San Antonio confluence); (bottom) VR03.5 (just below the Ojai Sewage Treatment Plant).

Figure 6. July 15, 2008, (top) VR03 upstream of Shell Road Bridge, (bottom) VR01 (just upstream of Main Street Bridge. Note dead cladophora in both locations.

Figure 7. July 15, 2008, away from the main channel algae on the lower river are doing much better. On top, cladophora, spirogyra and duckweed adjacent to the island at VR03.5; on bottom, cladophora and Ludwiga in the ponded area to the west of the main channel.

Figure 8. Since the sand-berm was re-established shortly after its breakdown on June 4th, water levels in the lagoon have slowly crept upward. There was no noticeable increase in filamentous algae in July and planktonic algae still dominate (note color in bottom photo).

Figure 9. Looking towards the ocean from the RR Bridge: the effect of slowly increasing water levels, since the re-establishment of the sand-berm, can be seen on the now-submerged island in the foreground. During this period planktonic algae have dominated. The slowness of the water-level rise can probably be attributed to reduced lower-river flows and increased evapotranspiration.

Figure 10. In the upper photo, VR07, San Antonio Creek just above the confluence. Almost all the algae is enteromorpha. Also notable is the extravagant growth of dense and tall weeds on the right-hand bank. Finally, the sediment problem at VR01 (probably caused by west-bank agricultural land grading operations continues – it has now been over two months – as can be seen by this photo from the Main Street bridge.