

Mara River Flows

Integrated Water Resource Management

... for people and for nature

November 2009

Greetings from the Mara River Basin! I know that last month's newsletter started with a dire report on the state of the ongoing drought in the basin. I am very pleased to report this month that the short rains came! Unfortunately, they also already left. For two weeks, starting about 9 November, beautiful thunderstorms graced the skies over the Mara every afternoon. The grass grew in places you forgot it was supposed to grow, and you remembered how lovely the savanna is turning golden green under the sunset. But about two weeks later, the rains started to diminish, and now it appears they are gone for the foreseeable future. The river showed a striking response to this sudden onset of rains, in the form of a large fish kill within the first few hours of rising waters. What caused this event? How is the river now? Read on to learn more...

State of the River

November started with remarkably low flow levels in the Mara River, and a Talek River that had essentially stopped flowing inside the Reserve. We were in Nairobi in the second week of November when we received a phone call from the Chief Warden of the Narok County Council side of the Masai Mara. His rangers had just reported a lot of dead fish along the bank of the river, the morning after the first heavy rain of the season. We rushed back to the Mara as soon as possible, but we had missed what turned out to be a pulse event. The fish kill only occurred just after the first rain, with no new carcasses appearing in the subsequent 3 days of heavy rain that followed. By the middle of the month, the river had dropped back down to levels even slightly lower than we saw in October, which you can see reflected in both the photos and water quality data shown below.



New Mara Bridge – October 15th, 2009



New Mara Bridge – November 14th, 2009

Water quality parameters for the Mara River

<i>Date</i> M/D/Y	<i>Time</i> hh:mm:ss	<i>Temp</i> C	<i>pH</i>	<i>DO%</i> %	<i>Salinity</i> ppt
10/15/2009	14:21:08	25.33	7.11	73.7	0.07
11/14/2009	14:22:40	26.25	6.88	66.5	0.08

Recently, some people have asked us why we don't include discharge data for the river in our newsletter. Indeed, discharge, or flow level, is considered a "master variable" in river ecology, and its relationship to water quality and ecosystem health in the Mara is the foundation of our research and monitoring. However, discharge data is normally taken using a staff gauge to measure river height, and there are currently no staff gauges on the Kenyan portion of the Mara River. The [Kenya Water Resources Management Authority \(WRMA\)](#) is working hard to resolve this issue, but they are challenged by a river that tends to sweep away staff gauges. In the meantime, we use a surveying rod and level to measure water surface level in relation to transects established during the Environmental Flows Assessment, and we work with a hydraulic engineer to estimate discharge using a rating curve he built for the transects. It's a bit complicated, and it takes some time to get the discharge data, but it yields critical information needed to interpret the rest of our findings.



Picture 1: Veronica, Fred and Amanda measuring a benchmark transect on the Mara River.

Research

As you may recall from previous newsletters, DO levels can vary throughout a 24-hour period, tending to rise during the day as algae and other aquatic vegetation undergo photosynthesis and decrease at night as they undergo respiration. As DO levels are critical to almost all aquatic life, we have become very interested in the way flow level alters DO levels in the Mara. In November, we conducted several 24-hour sampling periods in order to learn more about the normal daily fluctuations in the river. This understanding will aid our interpretation of fluctuations throughout the year.

Our first 24-hour sampling was done on the Talek River, only several kilometers upstream of its confluence with the Mara River. It was a bit challenging, because we needed a sampling location downstream of most of the tourism facilities, near one of our long-term monitoring sites, and safe enough that we could access the river throughout the night. [Rekero Tented Camp](#) was perfectly situated, and we had heard about their interest in our ongoing water quality monitoring, so we were grateful when they graciously agreed to host us for the sampling event. This was a remarkable time to sample the Talek, as it was the lowest we had seen it and had even stopped flowing in some places. Fortunately, the water was running in front of Rekero, and our sampling was conducted in a small section of riffles and runs. The following night, we sampled the Mara River at the Lower Bridge, near the border with Tanzania.

The difference between the two rivers is remarkable. Both rivers showed the same pattern of rising DO levels during the daytime and decreasing levels at night. However, the Talek was far more extreme, fluctuating between 30-144%, while the Mara ranged from 56-95%, as you can see in the graph below. This variation between the two is probably indicative of the highly eutrophic nature of the Talek, particularly under very low flow levels.

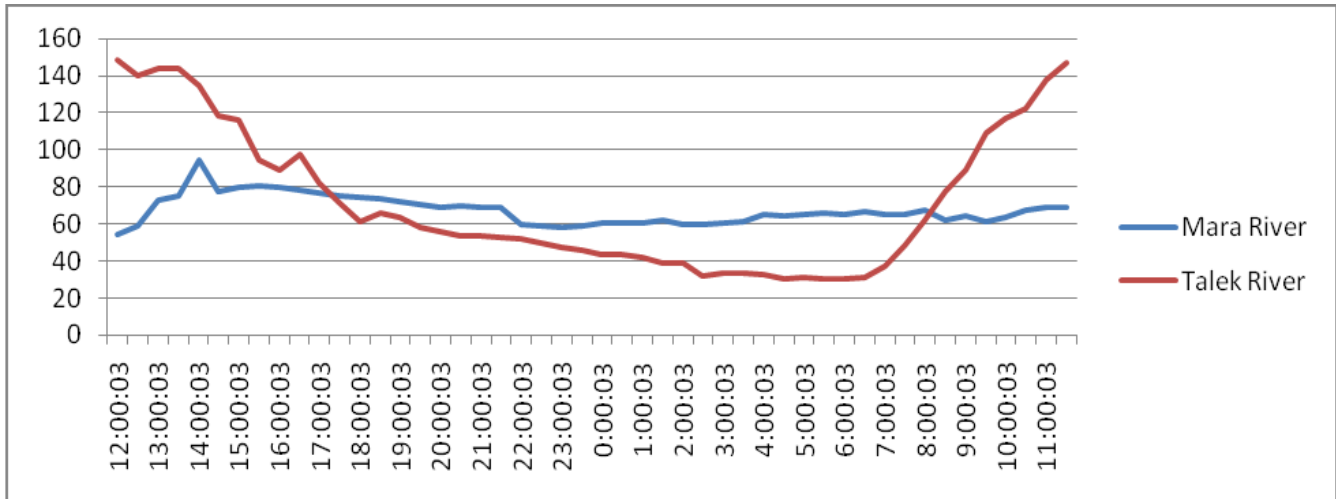


Figure 1: Percent saturation of dissolved oxygen throughout a 24-hour period in the Talek River on October 31st and the Mara River on November 1st, 2009.

After the fish kill happened two weeks later, we wondered if the first rains had caused a flush of nutrients into the system, which could have resulted in a wave of very low DO water that could have essentially suffocated the fish. We left our meter in the river for 2 days, hoping to catch another rain event and the subsequent impacts on water quality. Unfortunately, the very turbulent water destroyed the membrane on our DO meter, so we didn't get any DO data. However, we did observe some very interesting patterns. Both evenings, we experienced short but intense rainstorms at around 17:30. The first night, there was a small drop in both temperature and salinity, and we measured the turbidity at 1,300 NTUs just after the storm. The second night, there was a huge peak in salinity, over 5 times the level from earlier in the day. We're not sure what caused this peak, or why it happened the second night but not the first. It may have been related to where in the catchment the rains were falling, and what was being washed into the river. Either way, it taught us a lot about how dynamic the Mara River can be, and how important it is to monitor frequently. What exactly caused the fish kill is still a mystery to us, but we collected some water samples and aquatic insects, and we hope the analysis of these will yield some more information. To read a great summary about the event, check out this link to one of Chris's blog postings: <http://maraadventure.blogspot.com/2009/11/another-large-fish-kill-in-mara-river.html>

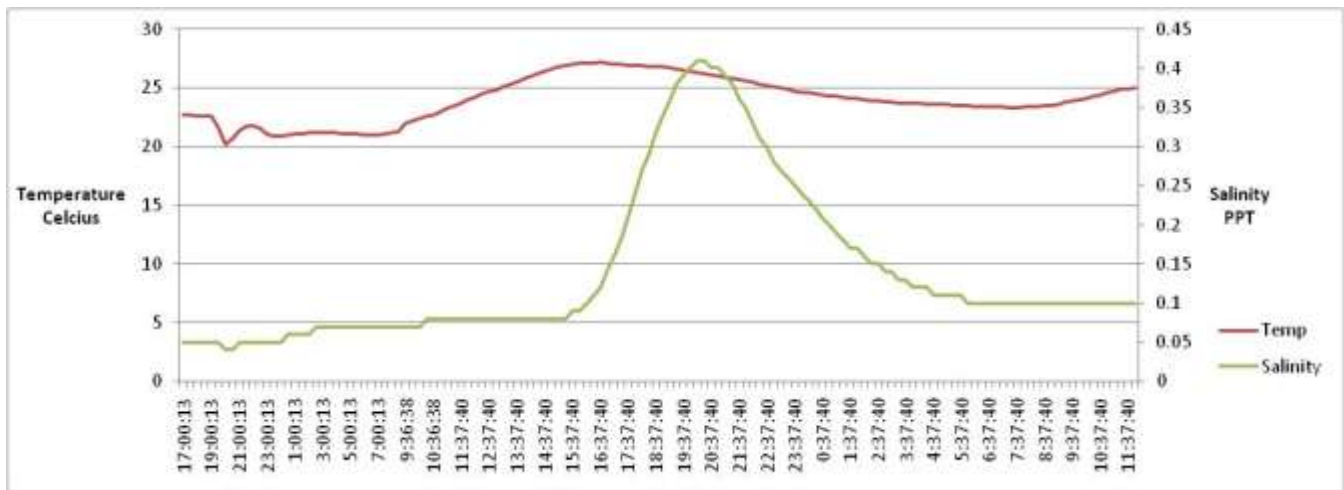


Figure 2: Salinity and temperature readings throughout a 42-hour period in the Mara River from November 13th through November 15th, 2009, three days after a large fish kill. Rain events occurred at approximately 17:30 on both days.

In other very exciting news, we just got back some of our data from the nutrient and heavy metal analyses we have been having done on the water samples we collected over the prior year. This data will be a large piece of the puzzle helping us determine the impact of flow levels on water quality and ecosystem health in the Mara, and we are really excited to start putting it all together. Unfortunately, the budget we had only covered the cost of analysis for about 1/3 of our samples, so we still have a lot of data missing. We are hoping to raise money for the remaining analyses through grants, so if you are interested in helping to fund this effort, please let us know.



Picture 2: Sampling during a hailstorm in the Mau Forest

November also signaled the beginning of some very exciting graduate research in the basin. Two new students arrived from [UNESCO-IHE Institute for Water Education](http://www.unesco-ihes.org/). Fred Omengo is a [KWS](http://www.kws.go.ke/) employee on study leave, and he is studying biogeochemistry and stream metabolism. Veronica Minaya is from Ecuador, and she is using benthic macroinvertebrates (eg., water bugs) to look at water quality and ecosystem health. They are both conducting their studies in the upper headwaters of the Mara, in the very small first and second order streams that feed the

Mara. Specifically, they are comparing streams that originate entirely from forested areas with those that originate entirely from cultivated areas, and they are already seeing striking differences. For example, many of the streams in cultivated areas are no longer flowing after the extended drought, while those from the forest are still flowing. Their data will be critical to understanding the impacts of deforestation in the Mau as well as current efforts to restore the forest. We had the pleasure of accompanying them during several days in the field, and although it was an incredible adventure, it was also remarkably challenging. The first day, we hiked 5 km into the Mau Forest and then took samples during a hailstorm!

In another exciting update about students funded through the GLOWS consortium, we recently visited our colleague Gibson Kiragu, who works at the [Kenya Ministry of Water and Irrigation](#). Gibson recently completed his MSc at [Jomo Kenyatta University](#), studying suspended sediment and heavy metals in relation to discharge in the Mara River Basin. He just returned from the [13th World Lake Conference in Wuhan, China](#), where he presented a paper on his research titled, “Assessment of Suspended Sediment Loadings and Their Impact on Environmental Flows of Upper Transboundary Mara River, Kenya.” The findings from Gibson’s study suggest that sediment loads in the Mara River are higher than allowable levels, according to Kenyan law. Of the rivers draining into Lake Victoria, the Mara is the second highest source of sediment, second only to the Nyando. In addition, these sediment levels may be associated with elevated levels of heavy metals, such as iron and zinc. Congratulations to Gibson for his important work! To read more about the World Lake Conference and the Wuhan Declaration, check out <http://www.chinalakes.org/>



Picture 3: Gibson Kiragu presenting his research on the Mara in Wuhan, China

Governance

October and November have been very full of planning for the new USAID-funded initiative in the Mara River Basin, which is being led by the [Lake Victoria Basin Commission \(LVBC\)](#) of the East African Community. This is a very exciting development in the basin, in which [USAID-East Africa](#) has given the LVBC \$3 million USD over the course of three years to implement the findings of the Environmental Flow Assessment and Biodiversity Action Plan that were developed for the Mara by [Worldwide Fund for Nature – Eastern and Southern Africa Regional Programme Office \(WWF-ESARPO\)](#), in collaboration with local and international universities, the Kenyan and Tanzanian governments, and other stakeholders in the basin. As the LVBC has a legal mandate to coordinate the implementation of sustainable development activities between partner countries, we are very excited about their new role in implementation of these important reports. A meeting has been planned for December to finalize the reports and print them for dissemination to Ministry officials and stakeholders in January. We look forward to keeping you posted on this as it develops.

In Chris’s new role as Coordinator of the [Transboundary Water for Biodiversity and Human Health in the Mara River Basin \(TWB-MRB\) Project](#), he has also been working very hard to sync the TWB-MRB work plan for the coming year with LVBC’s newly established work plan. These developments yield many opportunities for synergy between donors and implementers in the Mara River Basin, so we are anticipating some exciting developments in conservation in the basin throughout the next year.

Partners on the Ground

The TWB-MRB Project is a USAID-funded project aimed at implementing a coordinated and highly participatory project to improve water resource management in ways that reduce and mitigate threats to biodiversity in the Mara River Basin and Mara-Serengeti Ecoregion and enhance the health and livelihoods of communities living in the basin. Last month, we covered some of the work by one of our



Picture 4: Rock catchment with water storage tank downhill



Picture 5: Community in Kirindon on their rock outcropping

partners in this project—WWF-ESARPO. This month, we visited with [WorldVision – Kenya](#). WorldVision has been doing some excellent work in the Kirindon District of the Mara River Basin since 2004, with support from USAID since 2007. We were excited to visit one of their recently constructed projects that was new to us—a rock catchment. Elegant in design and built to compliment a unique natural feature, rock catchments are rainwater harvesting structures for those blessed with large rock outcroppings in their backyard. A fence around the rock protects the surface from contamination and the water running off the rock face is funneled into a storage tank.

WorldVision makes a point of working with the community so they can contribute some of the materials and supplies needed to complete the project, which enhances community ownership and project sustainability. For this project, the community was contributing the sand for the concrete catchment walls and tank and the fence posts to protect the catchment. When we arrived to view the project, we were greeted by the community, singing songs and shaking our hands, and they gave speeches welcoming us and thanking WorldVision for their contribution to the community. It was inspiring to see such a unique approach to providing water for a community that has no other nearby water sources.

Another of our new partners on the ground is [Rekero Tented Camp](#). During the sampling event we conducted from their camp, we had the opportunity to learn about some of the eco-friendly approaches the camp is using to minimize their “ecological footprint” in the Masai Mara. Rekero’s commitment to ecotourism is reflected in their recent application for a [silver rating](#) from the [Ecotourism Society of Kenya](#), and we were pleased to support them in their application. If all the tourism facilities in the Mara took such a conscientious approach, we wouldn’t have to worry about human impacts coming from *inside* the protected areas.

Other Interesting Happenings

We have started developing a resource center at the WWF office in Narok and the Mara River Water User’s Association office in Mulot, so we have been busy locating and printing all documents we can find on the Mara River. We were particularly excited to located Holly Dubin’s doctoral dissertation on the role of elephants in shaping the vegetation communities in the Masai Mara. We found it at the

[Heritage Center Library at the National Museums of Kenya](#)—an excellent resource center for the region—and they were kind enough to scan it for us. You can find a number of these reports on our [blog](#).

Finally, we can't leave you without another epic breakdown adventure... on our way to Sekanani Gate last week, we were thrilled to find a pride of lions relaxing under a picnic tree. One lioness was laying on a picnic table, four others were reclining in the sun, and two big males were in the shade—a true wildlife tableaux. After viewing them for a while, we pulled back onto the main road about 100 m away and our car came to a dead stop. As we were standing in the road, looking under the hood and discussing the matter, the lionesses stood up and began walking straight for us! By the time they were about 30 m away, staring right at us, we decided we must look like wounded zebra, so we got back in the car and rolled up the windows. An exciting breakdown, but not as scary as seeing this view of our timing belt...



Picture 6: Shredded timing belt on our trusty Land Rover

We learned very quickly how important timing belts are when we realized other parts of our engine had broken or bent during the belt's demise, but we were incredibly lucky to be helped out by some great friends. The mechanics at the [Mara Conservancy](#) towed our truck out of the lion pride and spent two days helping us re-build our engine, and the good folks at [Governor's Camp](#) sent over some engine parts to get us rolling again. Just another grand adventure inside the Masai Mara!

See you next month!

November took us from the headwaters of the Mara to the border of Kenya, and December will take us all the way to the Mara's mouth in Lake Victoria. We look forward to bringing you pictures and stories of our travels and updates on the Mara River!

Who are we?

Amanda Subalusky is the Research Coordinator – East Africa for Florida International University. Christopher Dutton is the Coordinator of the Trans-boundary Water for Biodiversity and Human Health in the Mara River Basin (TWB-MRB) Project. We both work within the GLOWS consortium. Read more about us at <http://maraadventure.blogspot.com>

What is GLOWS?

GLOWS is a consortium financed by the United States Agency for International Development (USAID) working to increase social, economic, and environmental benefits to people of the developing world through clean water, healthy aquatic ecosystems and sustainable water resources management. Read more about it at www.globalwaters.net