



Mara River Flows

Integrated Water Resource Management

... for people and for nature

August 2009

Welcome to the August edition of our monthly newsletter, Mara River Flows. We have been expanding our readership recently, thanks to some great publicity by the Mara Conservancy, so welcome to any new readers. We, Amanda Subalusky and Chris Dutton, are conducting research on the Mara River in partnership with the Kenya Ministry of Water and Irrigation, Florida International University, WWF-ESARPO and USAID. This newsletter is our effort to keep people both here in the Mara River Basin and abroad updated on the state of the river, our ongoing research on the relationship between flow levels and ecosystem sustainability, and political and grassroots efforts to promote conservation in the Basin.

State of the River

This August marked one full year of our sampling effort in the Mara River Basin. We have been collecting data on flow level, water quality and biological indicators of ecosystem health since August, 2008, at 11 sites from the middle-upper catchment to the border between Kenya and Tanzania. By collecting this data throughout an entire year, we have been able to capture some of the natural high and low flows in the river. We plan to analyze our water quality and biological data in relation to those flow levels to help us determine critical minimum flow levels below which river health begins to decline.

The Mara River has two distinct peaks in flow level, typically between September-October and between March-June. August, at the end of the dry season that follows the long rains and before the onset of the short rains, typically has fairly low flows; however, this can vary widely across years. The difference between flow levels in August of 2008 and 2009 is a remarkable example. With the general failure of both the short and long rains last year, flow levels this year are significantly lower than last year, as you can see in the pictures below.



New Mara Bridge – August 23rd, 2008



New Mara Bridge – August 7th, 2009

You can see the effects of these lower flow levels on the water quality in the river as well. In the table below is a list of typical water quality parameters collected at the same site, New Mara Bridge, on August of 2008 and 2009. Both conductivity and salinity are four times greater, pH has gone up over one unit, and temperature is 2 degrees higher. But one of the most striking differences is the change in dissolved oxygen (DO), which aquatic species rely on for their survival. August, 2009, flow levels weren't as low as the river got at its lowest point this year, in March 2009, but the DO levels in August dropped 10% lower than the values we recorded on the lowest flow day (40%). We also noticed a substantial amount of hippo muck building up on the rocks in nearly dry riffles. Not only does this displace sensitive species which rely on the microhabitats available in riffles, but its decay in the absence of sufficient flow levels can lead to very high peaks in nutrient loads and subsequent declines in DO levels, which can have negative effects on aquatic species. We eagerly await the results of our nutrient analyses to decipher these relationships in greater detail.

Water quality parameters in the for the Mara River – 2008 and 2009 snapshots

Date M/D/Y	Time hh:mm:ss	Site	Temp C	DO %	pH	Conductivity mS/cm	Salinity ppt	TDS g/L
8/23/2008	11:42:00	Mara River	21.21	75.5	6.57	0.080	0.04	0.052
8/7/2009	9:08:09	Mara River	23.11	30	7.65	0.359	0.18	0.242

These lower DO levels could also be related to increased nutrient loads associated with the wildebeest migration, which is currently in full swing. We hypothesize the increased defecation in the river bed and rotting carcasses from mortality events during the frequent river crossings may be a substantial nutrient input into the river, with subsequent effects on the structure and function of the river ecosystem. However, with these very low flows, wildebeest have been crossing the river easily, barely getting their ankles wet, and mortality from crocodile attacks and drownings is down. This decrease in wildebeest mortality may be one of the many indirect ways that lower-than-average flows can affect the functioning of the aquatic ecosystem.

Research

We will be able to learn more about nutrient dynamics in the river through analysis of water samples. In the past year of sampling, we have collected close to 300 water samples, which we are planning to analyze for carbon, nitrogen, phosphorous, a series of ions, and several metals (iron and aluminum). We have some money for this effort, but at \$200 USD per sample, our current funding will only pay for 1/3 of them to be analyzed. We are hoping to raise some additional money for this effort, or we will try to arrange several weeks in January to run the remaining samples ourselves.

As we conclude one full year of our sampling effort, we are in the process of designing a new sampling protocol for the coming year. Past water quality research on the Mara River has sampled points throughout the entire basin once a year. With this past year's work, we sought to increase the resolution of our understanding of impacts on water quality and river health by sampling fewer sites at greater frequency. Now we would like to increase our resolution to an even finer scale, by focusing our work on several sensitive sites within the Masai Mara National Reserve. With the support of the Mara Conservancy offering to host us in their research campsite, and the extension of our time here in the Mara through August, 2010, we have a unique opportunity to develop a detailed baseline understanding of the relationship between wildlife and hydrology inside the Masai Mara.

During the coming year, we plan to study macroinvertebrate and water quality indicators at a finer spatial and temporal scale to gain a more detailed understanding of the ecological processes within the river. For example, what is the normal cycle of dissolved oxygen and nutrient levels within the river within a 24 hour period, and what are the factors driving both those cycles and extreme events? In addition, we plan to investigate the relationship between larger wildlife and the river. We are interested in studying the dependence of large wildlife on the river; for example, how the linkages between groundwater and surface water inside the protected areas affect wildlife water use and distribution. We are also interested in the role large wildlife plays in structuring the river ecosystem through nutrient input in the form of hippo defecation and wildebeest mortality events. For example, with decreased wildebeest mortality due to low flows during the 2009 migration, what will be the subsequent impacts on the river ecosystem? We hope to be posting our new research plan in the coming month, so we will include more details of our sampling protocol in next month's newsletter.

We also had some visiting scientists in the Mara River Basin this month—Jeff and Kiki Onsted from Florida International University. Jeff is a Professor in the Department of Environmental Studies, and he was interested in searching for any historical documents available for the Mara River. Using aerial photos and satellite images from different periods of time is an



invaluable tool for studying and quantifying changes in land use and land cover over time and the subsequent impacts on the river. While we currently have digitized data from the 1970's, Jeff was interested in locating even older data, in the form of aerial photos or maps, which could inform us more about the historical context of the river basin. Although he only had two and a half weeks to accomplish his mission, Jeff was successful in locating several old maps in the National Archives, topographic quads from the 1972, and aerial photos from 1959! He also learned of the existence of aerial photos from the 1947, but these are currently out of our price range.

Politics

WWF-ESARPO is in the process of developing a proposal to fund work on water security in Kenya and Tanzania. The project will focus on the policy and legislative frameworks necessary to secure sufficient quantity and quality of water for people and for nature, and one of the focal sites for the study will be the Mara River Basin. Amanda has been participating in workshops with WWF and members of the MOWI, the Lake Victoria Basin Commission and others to develop this proposal. This work will provide the critical framework necessary for implementing the findings of our research.

A number of important political events are coming up in September and October, including the formation of a National Stakeholders Forum for the Mara River Basin for both Kenya and Tanzania, and the development of a Partnership for the Mara River Basin to support water quality monitoring and improvement. You can expect more details on these events in the coming months.

Other Interesting Happenings



In addition to completing our year of research, we have also been very busy this month with a new GLOWS project on water supply and sanitation in Tanzania that will be developed within a river basin framework. Chris has been tasked with bringing together the partners and steering the development of a proposal for USAID, and it has been an incredible learning experience. It has also been a great opportunity for us to apply some of our lessons learned in the Mara to new river basins.

One of the river basins which this project will target is the Great Ruaha River. The Great Ruaha is similar to the Mara, in that the upper catchment is heavily developed for agriculture and in the middle of the basin, the river flows through Ruaha National Park. However, in 1993, unsustainable abstraction levels caused the river to stop flowing in the park during

the dry season. The river has stopped flowing every dry season since then for increasing periods of time. Recent efforts by WWF and the Wildlife Conservation Society, in conjunction with the Rufiji Basin Water Office, to improve land and water resource management in the basin have led to improvements in the river. Although it still stops flowing each year, the dry sections of river are increasingly far apart. However, there are still huge challenges to re-instating year-round flow, and alternatives such as digging canals from other rivers and damming the river to regulate year-round flow are starting to be discussed. This is a great example of what can happen to a river as a result of poor resource management and unsustainable abstractions, and it should be a dire warning to us in the Mara. We are fortunate to have the opportunity now to improve management practices while the river is still flowing. Let's not wait until it has already run dry.

In their ongoing support of us and our research in the Mara, the Mara Conservancy has added a new section about us to their website. You can find it at <http://www.maratriangle.org/mara-river-basin-research/>

The page has a write-up about our current and future research plans along with funding needs, links to our blog and monthly newsletters, and a form through which readers can send us e-mails. While you're there, you should check out the rest of the Mara Triangle webpage. They are a great organization doing wonderful work to conserve the Mara, and we are very honored to be affiliated with them. Thanks Mara Conservancy!

However, not everyone is as interested in our research. Despite the discussions, information and contacts we provided to 60 Minutes during their visit here in June, when they returned this August to film the Mara River, they never contacted us. As they seemed to be looking for instances of conflict in the Basin, we were a bit relieved not to be questioned by them. It will be interesting to see the story when it airs. Hopefully it will shed light on both the challenges and the successes of conservation in the Mara.



And finally, we couldn't leave you without another classic breakdown story. Those of you who have been following our adventure are well acquainted with our 1988 Land Rover. She's the iconic African bush vehicle, but after 20+ years on the Kenyan roads as a research vehicle, she's got a lot of character. We wanted Jeff and Kiki to experience a true research trip, so we made sure to breakdown twice on the way out of town. The second time, we

were lucky to have the first car that passed by stop to help. Well, I guess you could call it lucky. It was a liquid petroleum gas tanker, but the gentlemen driving it were more than happy to hook us up and tow us back to town. As they were attaching the tow straps,

Chris asked, “Is your tanker leaking?” “Yes,” they replied matter-of-factly, trying to stop the leak as they finished attaching the tanker to the car. As we rolled back into Narok, being careful to maintain as much distance as the tow strap would allow, Jeff and Kiki earned their first badge of courage as Kenyan field researchers.

See you next month!

We look forward to returning to the Mara for longer periods of time in the coming months. Thus, we hope to have plenty more great stories and pictures to share from the field. We have heard some rains have started in the Mara, and there is talk of an El Niño this year... after a year of studying the Mara during drought, we may have the chance to see this river flood!