Surface Hydrology

Resource Brief
October 2011

Importance

All biophysical interactions within SWAN aquatic systems are heavily influenced by hydrology. Maintaining the natural variation of hydrologic processes is critical to protecting the cultural, ecological, recreational, and economic value of aquatic resources Congress identified in establishing SWAN parks. Large-scale disturbances, such as climate change, can have a profound effects on hydrologic processes, such as increased stream flows from glacial melting or decreased ice cover on lakes. These effects would result in impacts to fish and wildlife populations as well as the associated human activities.

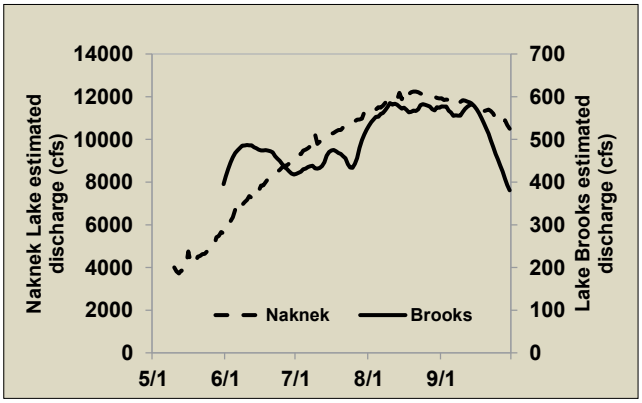
Hydrologist Paul Burger uses an acoustic Doppler current profiler (ADCP) to measure discharge at Lake Brooks outlet (KATM). Doppler technology integrates channel area, depth and velocity data to compute discharge. The ADCP communicates with software on laptop using bluetooth technology.

Long-term Monitoring

Discharge and water level measurements are two hydrologic parameters critical to understanding the biophysical patterns observed in aquatic systems. These parameters dictate a wide variety of physical, chemical, and biological interactions that structure freshwater flow systems from nutrient loading to the timing and success of fish spawning. Disturbances that alter the timing and magnitude of hydrologic features within SWAN park units will likely have a trickledown effect and impact all freshwater flow system interactions. SWAN will monitor daily discharge into and out of large lake systems in Kamai NPP (KATM) and Lake Clark NPP (LACL) as well as lake level fluctuations during the ice-free period. These measurements will allow us to document the inter-annual variability of the ice-free season as well as estimate the timing and magnitude of peak discharge. By comparing glacial to non-glacial systems, we will also be able to monitor the effects of climate change on hydrologic processes, especially when our results are integrated with glacial extent monitoring.

Discussion

The five year period of record (2006 – 2010) for estimated discharge in the Naknek Basin (KATM) shows a clear difference in the hydrograph structure between glacial (Naknek Lake) and non-glacial (Lake Brooks) lakes. While glacial and non-glacial lake levels increase due to spring snowmelt runoff, lake level is sustained throughout the open water season by glacial runoff in Naknek Lake, and the peak is recorded in late summer. In Lake Brooks, lake level declines as snowmelt runoff ebbs and the summer hydrograph is dominated by precipitation. During years of average or greater summer rainfall, a second peak emerges in the hydrograph. Peak discharge may be associated with snowmelt runoff or seasonal precitipation. Results indicate that over the short-term, the hydrologic cycle in non-glacial lakes maybe more affected by climate change; however, over the long-term, as glacial input declines, the Naknek hydrograph may show a shift in peak discharge and lake volume.



Mean daily discharge for Lake Brooks and Naknek Lake during the open water season for 2010. Note the order of magnitude difference in discharge between the two sites and the two peaks observed in Lake Brooks, a non-glacial lake.

Contacts: Claudette Moore, NPS-SWAN, Claudette_Moore@nps.gov
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