



Project Status Report 99-10

Upper Mississippi River
Long Term Resource Monitoring Program
U.S. Geological Survey

Recent Sedimentation Rates behind Constructed Islands in Lake Onalaska, Pool 7, Upper Mississippi River System

by
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Since impoundment of the Mississippi River in the late 1930's, resource managers have been concerned about a reduction of habitat diversity in backwaters of the Upper Mississippi River System. Lake Onalaska, a backwater in lower Pool 7 with a mean depth of 1.3 meters, consists of open water, islands and channels. Flow patterns and summer wind/wave action create a situation where fine sediments are transported through this 2,800-hectare backwater lake. In an attempt to improve water clarity, lessen wind/wave induced erosion and create backwater habitats, three crescent-shaped islands (Arrowhead, Broken Gun and Cormorant) were constructed in Lake Onalaska by the US Army Corps of Engineers (USACOE) as part of a 1989 Habitat Rehabilitation and Enhancement Project. As artificial structures are constructed to create more diverse habitat, it is important to monitor and understand the effects these structures have on sedimentation rates.

Beginning in the winter of 1992-1993, employees from the Long Term Resource Monitoring Program set up five high resolution sediment range transects in the sheltered zone downstream of each constructed island to monitor bed elevation change, as shown in Figure 1 for Broken Gun Island. The transects on each island originated at fencepost locations, surveyed by the USACOE, with each transect line attained by turning a known angle from an adjacent fencepost. All surveys were conducted during the winter, when ice cover promoted precise replication and the small changes expected annually could be detected. A measuring tape was placed over the ice along the transect with holes drilled every 6.1 m, out to a minimum of 91.4 m or a maximum of 128 m depending on the transect, through which water depths were measured with a sounding pole. Vertical control was derived from a vertical control point on shore near the islands and by using the eleva-

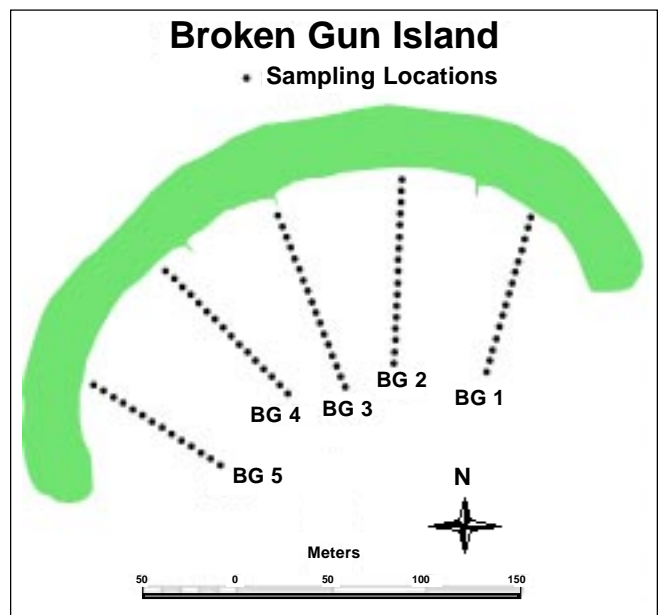


Figure 1. Location of sediment range transects for Broken Gun Island in Lake Onalaska, Pool 7, of the Upper Mississippi River System (1993-1998).

tion of the island fenceposts relative to each yearly water surface elevation.

Bed elevation change was measured at 249 locations for each time period. There were sixteen occurrences, almost always near shore, when the yearly accumulation or erosional rate was greater than 10 cm. These high rates may have been caused by shoreline sluffing or human disturbance and were not included in the data set.

Mean sedimentation rates were calculated for each transect and for each island. For the period of record (1993-1998),

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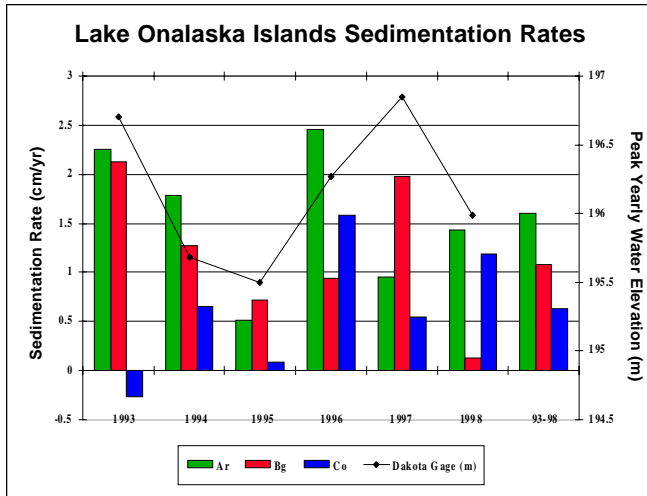


Figure 2. Sedimentation rates and peak yearly water elevations for Arrowhead (Ar), Broken Gun (Bg) and Cormorant (Co) Islands in Lake Onalaska, Pool 7, of the Upper Mississippi River System.

Arrowhead, Broken Gun and Cormorant Islands had mean sediment accumulation rates of 1.60, 1.08, and 0.63 cm/yr and mean water depths of 1.38, 1.42 and 0.88 m, respectively. All yearly time periods for each island showed net sediment accumulation except for Cormorant Island in 1993, which showed a net erosional rate of -0.27 cm/yr (Figure 2). Some of the lowest net sedimentation rates for Arrowhead (0.51 cm/yr), Broken Gun (0.72 cm/yr) and Cormorant (0.09 cm/yr) Islands were produced during 1995, possibly the result of it being a relatively low water year. Arrowhead transect 2 had the greatest mean water depth (1.57 m) and also the highest net sediment accumulation rate (2.32 cm/yr) for the period of record. Conversely, Cormorant transects 3 and 4 had the shallowest mean water depths of 0.53 m and 0.5 m and had net erosional rates for the period of record at -0.04 cm/y r and -0.69 cm/yr, respectively. They were also the only transects found to have net erosion for the period of record and were the only transects with an average water depth of less than 1 meter. For the fifteen transects over the six yearly time periods calculated, net erosion occurred fifteen times, with most of the erosional time periods occurring behind the shallower Cormorant Island. One of the locations with the highest accumulation rates (4.62 cm/yr) occurred on Cormorant transect 2

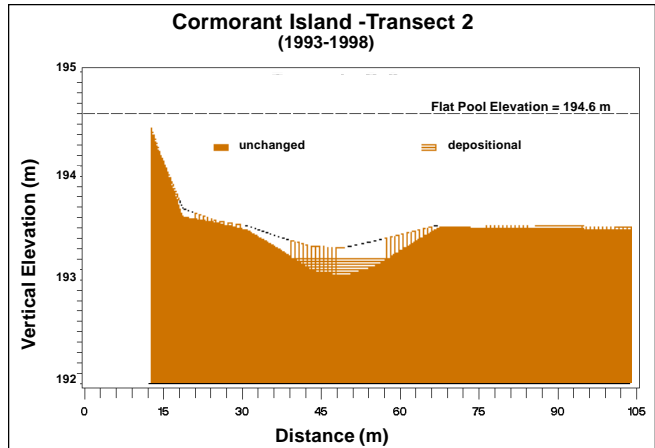


Figure 3. Sediment accumulation rate for Cormorant Island Transect 2 in Lake Onalaska, Pool 7, of the Upper Mississippi River System.

(Figure 3). This transect differed from the other transects in that there was a 46 cm depression present in 1993. By 1998, the depression was reduced to 21 cm by sediment accumulation.

The sheltered zones behind the constructed islands efficiently trapped sediments, as evidenced by the relatively high sedimentation rates observed, and also created more diverse habitat, as verified by bathymetric surveys. Apparently, water depth played a role in sedimentation rates and transects that were less than 1 m deep had changes suggesting that sedimentation had reached some sort of equilibrium. We also found that sediment focusing (transport of sediment from shallow areas to deeper areas) occurred along Cormorant transect 2. Monitoring will continue to accurately predict the future conditions of the sheltered zones behind the constructed islands. □

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