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Environmental Effects of Dredging Technical Notes

THE VALUE OF GRAVEL DISPOSAL MOUNDS IN RIVER SIDE CHANNELS FOR FRESHWATER MUSSELS

PURPOSE: This note provides information on the value of gravel disposal mounds in river side channels for freshwater mussels. Basic guidelines are suggested from this information to guide site selection for beneficial disposal of gravel.

BACKGROUND: Gravel shoals occasionally must be dredged from river navigation channels. Side channels (i.e., the channel around islands that does not include the marked navigation lane) have historically been preferred sites for disposal of such dredged material. Multiple disposal events form closely adjacent disposal mounds during each maintenance dredging operation. These coarse-grained sediment mounds in flowing water are potentially valuable habitat for a number of riverine fishes and invertebrates (Miller et al. 1988) including commercially and ecologically valuable as well as some Federally Endangered species of freshwater mussels (Miller et al. 1987, Payne and Miller, in preparation). Many gravel shoals in large inland rivers were destroyed by major alterations of inland rivers, such as dredging and impoundment, to support navigation and other uses of waterways (e.g., Isom 1969). Strategic placement of dredged material can be used to re-create riverine gravel shoals without interfering with other uses of inland waterways.

This note describes the results of a field study conducted in September 1988 to evaluate the mussel community on disposal mounds of known location and age in a side channel of the Tennessee River. The study was conducted by Dr. Barry S. Payne (Environmental Laboratory, US Army Engineer Waterways Experiment Station) with the assistance of Mr. Richard Tippit (Environmental Resources Branch, US Army Engineer District, Nashville) and divers Larry Neill, William Host Jr., and John Wilson (Tennessee Valley Authority, Muscle Shoals, AL).

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Study Area

Gravel disposal mounds were created adjacent to the right bank of the Tennessee River in a side channel of Wolf Island (River Mile 192-194) as part of dredging operations in 1972, 1981, 1983, and 1988 (Figure 1). In each year, sandy gravel was removed from the navigation channel in the main channel of the Tennessee River using a clam shell dredge. Disposal was accomplished using dump scows. Typically, the dump scow was pushed, at an acute angle into the flow, against the shore at the disposal site, and the dredged material was released from doors in the bottom of the scow as it was slowly backed from the shore. An average dump scow load was 225-250 cu yd. Totals of 29,000, 18,000, 28,000, and 10,000 cu yd of dredged material were disposed in 1972, 1981, 1983, and 1988, respectively. Each successive disposal event in a particular year occurred just upstream of the previous one so that a series of closely adjacent mounds were created. No intentional shaping or contouring of disposal mounds was attempted during disposal. The substrate created by 1983, 1981, and 1972 disposal operations is mostly gravel and cobble. The substrate at the 1988 site, although still gravelly, includes patches of sand among gravel and cobble. The coarse-grained nature of sediments at these sites is maintained by substantial flow (greater than 0.5 ft/sec) that prevent sedimentation of fine-grained particles.

Approach

The assessment of mussel habitat near Wolf Island was performed on 15 and 16 September 1988. Divers sampled sites of 1988, 1981, and 1972 disposal operations as well as an upstream reference area (not disposed on) along the side channel border (open symbols in Figure 1). At each site, a 10-min reconnaissance dive was conducted to preliminarily assess the presence and approximate density of mussels. If mussels were present, subsequent dives were conducted to obtain as many individuals as possible within a total diving time of 50 min along a 100-ft transect. Mussels were collected by touch because visibility in the water was poor. See Miller and Payne (1988) for a discussion of qualitative and quantitative methods of surveying mussel beds.

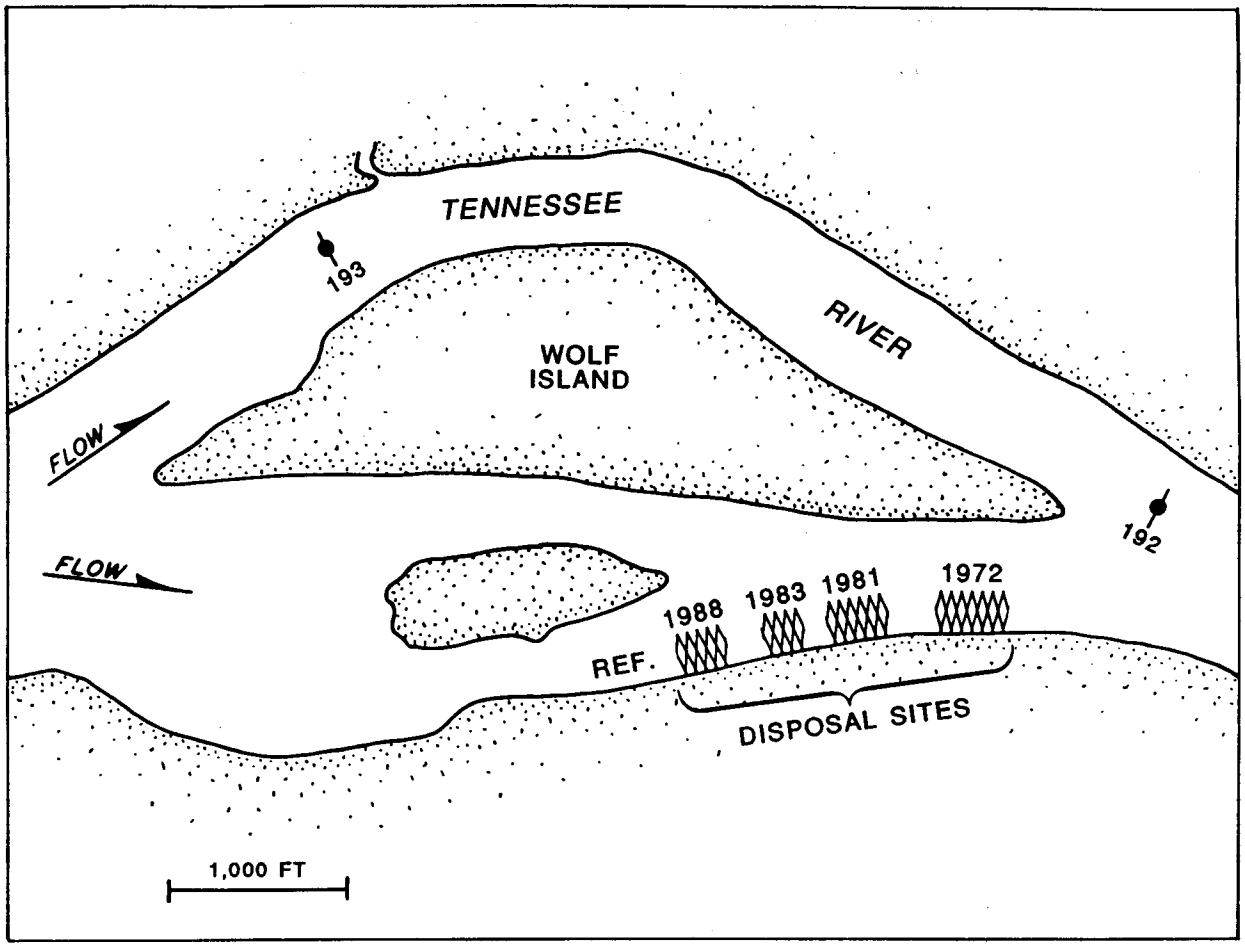

Figure 1. Location of dredged material disposal mounds and sampling sites in the side channel of Wolf Island in the Tennessee River

Results and Discussion

The transect at the reference site showed that the natural side channel border ranged from sand nearest the eroding bank shoreline to relatively fine gravel on the main part of the channel border. The transition from sand to gravel occurred at a depth of approximately 8 ft and a distance approximately 100 ft offshore, then to coarser gravel and cobble on the steepest portion of the slope down into the side channel. Disposal of gravel along the shoreline in 1972, 1981, and 1983 appears to have stabilized an otherwise sandy and eroding bank and created a relatively stable gravel shoal that otherwise would not form at this location. The deep portion of the side channel is characterized by water velocity greater than 1.0 ft/sec and sediments range from scoured clay to gravel and cobble.

The gravel mounds created by 1972 disposal operations (Figure 1) supported the greatest number of mussels observed on the back channel border (Table 1). The 1981 disposal mounds, having had less time for natural colonization by juvenile mussels, showed a lower density of mussels than the 1972 mounds. No mussels were found during the reconnaissance dive at the site of 1988 disposal operations. The reference area did not support as many mussels as the 1972 mounds, indicating that gravel disposal along the shore and shallowest reaches of the channel border has enhanced the value of these areas for mussel. The pink heel-splitter, *Proptera alatus*, dominated samples from the disposal mounds.

The greatest density and diversity of mussels behind Wolf Island occurred in the deep portion of the side channel away from the shallow side channel

Table 1

Mussel Community Samples from Sites behind Wolf Island near Tennessee River Mile 192.5*

Species	Number of Individuals		
	Reference Site	1981 Disposal Site	1972 Disposal Site
Quadrula metanevra	1	1	--
Fusconaia ebena	--	--	4
Quadrula pustulosa	--	--	1
Elliptio crassidens	--	--	3
Cyclonaias tuberculata	1	--	--
Proptera alatus	1	3	18
Megalonaias gigantea	--	--	1
Ligumia recta	--	1	2
Total number of species	3	3	6
Total number of individuals	3	5	29

* Total diving time at all sites was approximately 50 min; thus, comparison of the total individuals collected per site indicates the density of mussels at one site relative to others.

border where disposal occurred.* The main assemblage of mussels in the deeper side channel was dominated by the monkeyface, *Quadrula metanevra*, and the ebony shell, *Fusconaia ebena*. Disposal of dredged material in the shallow portion of the side channel border has not only avoided burial of this important mussel assemblage, but has also provided stable gravel shoal to this otherwise sandy shallow area and created new mussel habitat. Over the past 17 years mussels have naturally colonized the stable gravel disposal mounds, with the density of mussels being proportional to the age of the mounds. Disposal has had the additional benefit of helping stabilize an eroding bank.

Basic guidelines for site selection for beneficial disposal of gravel in a river side channel are suggested by this investigation of conditions behind Wolf Island in the Tennessee River. First, disposal sites should be selected based on knowledge of the distribution of important aquatic resources. Burial of all or a portion of the dense and diverse mussel bed in the deep portion of the side channel was avoided by selection of disposal sites along the shoreline. Disposal along the shoreline had the added benefit of stabilizing eroding banks and creating a stable gravel shoal. The potential for bank and shoreline stabilization should be considered during the selection of aquatic disposal sites. By creating a stable gravel shoal where none otherwise existed, disposal added mussel habitat to the side channel. Site selection should consider bathymetric and hydrologic conditions in an attempt to create gravel disposal mounds that will neither be severely eroded nor covered by silt.

References

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* From unpublished data, Tennessee Valley Authority, Knoxville, TN; confirmed during the present investigation.