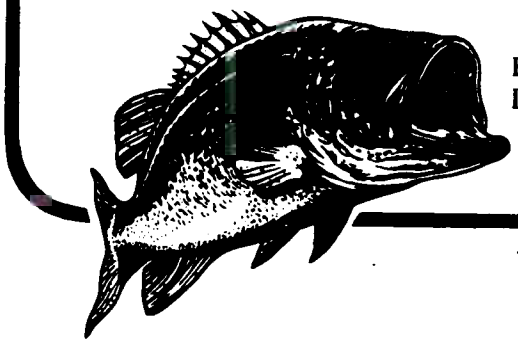
ILLINOIS NATURAL HISTORY SURVEY

EFFECTS OF FLEETING ON MUSSELS

Aquatic Biology Section Technical Report

Richard E. Sparks
and K. Douglas Blodgett



Report to the Illinois
Department of Conservation, August 1985

Aquatic Biology Technical Report, 1985 (8)

State Natural History Survey Division

ENR

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Illinois Department of
Energy and Natural Resources

7 May 1986

The enclosed interim report, "Effects of Fleeting on Mussels", is being sent to everyone on the attached mailing list who has requested information about our fleeting project. Please check your name and address and send corrections to me at the above address, if you wish to continue receiving updates on our mussel research. If I do not hear from you, I will assume your address is correct.

I would like to call your attention to Appendix E in our report: Emergency Sampling to Verify Reports of a Mussel Die-off in the Upper Mississippi River. Starting in July 1982, commercial clammers and fishery biologists reported a die-off of mussels in the Upper Mississippi River. Smaller die-offs have occurred since 1982 and another large die-off in July, 1985. The die-offs in the Upper Mississippi, and other midwestern rivers, will be the subject of a national workshop on mussel mortality 23-25 June, 1986, in Davenport, Iowa, organized by Dr. Richard Neves of Virginia Polytechnic Institute and State University (copy of workshop announcement attached). These unexplained die-offs may be a more serious threat to mussel populations than fleeting or commercial harvesting.

We will periodically resample beds on which we have good historical data, and would like to exchange information on mussel mortalities and recruitment in the Upper Mississippi and Illinois rivers with other investigators.

Richard E. Sparks

Richard E. Sparks

A Workshop

DIE-OFFS OF FRESHWATER MUSSELS IN THE UNITED STATES

Sponsored by

U.S. Fish and Wildlife Service
and
Upper Mississippi River Conservation Committee

June 23-25, 1986
Davenport Holiday Inn
Davenport, Iowa

A workshop to discuss the problem of mussel die-offs in recent years throughout the central U.S. is scheduled to begin at 1 p.m., June 23 through noon, June 25 at the Davenport Holiday Inn. Tentative agenda for the meeting will include presentations by state/federal biologists on recent die-offs in major rivers and efforts to identify causes (case studies). Invited speakers are being sought to discuss environmental contamination, diseases, and other potential mortality factors, as they affect mollusks. A field trip to a nearby shell camp is scheduled for the morning of June 25. The purpose of this workshop is to assemble biologists and researchers with interest/responsibility for freshwater mussel populations, stimulate interest in mussel research, exchange information on the die-off problem and prescribe future efforts to resolve the cause(s) of these mussel die-offs.

Persons interested in attending this workshop or making a presentation on a case study, research project, or other topic pertinent to the die-off problem should contact:

Dr. Richard J. Neves
Cooperative Fish and Wildlife Research Unit
Department of Fisheries and Wildlife Sciences
Virginia Tech
Blacksburg, VA 24061
(703) 961-5927

Attendees will receive a program for the workshop in subsequent correspondence. A registration fee of $10 will be collected at the meeting.

Accommodations

Conference will be held at the Davenport Holiday Inn, with free van service from the Moline airport. Those arriving by air should fly into Moline, IL.

Davenport Holiday Inn
53rd and Brady St.
(1.5 miles off I-80)
Single $38; Double $43
Tele# 319/391-1230

Nearby Motels ($25-36/night)
Excel Inn
Tele# 319/386-6350
Motel 6
Tele# 319/391-1300

Illinois Natural History Survey

Aquatic Biology Section Technical Report 1985 (8)

INTERIM REPORT

Effects of Fleeting on Mussels

Project No. 1-5-39667

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Illinois Department of Conservation

August 1985

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ACKNOWLEDGMENTS

This study would not have been possible without the cooperation of the Naples Terminal Company and Naples Marine Service, Naples, IL. We are grateful to Mr. Larry Jamison of Naples Marine Service and his crew for moving barges, relaying messages to us, watching over our equipment, and even radioing other vessels to insure our safety while we were diving.

We are grateful to our summer divers: Mr. Don Craig, Florida Institute of Technology; Mr. Larry Durham, Mr. Russell Boone, and Mr. Carroll Moore of Eastern Illinois University, Charleston, IL; Mr. E. "Butch" Atwood, Illinois Department of Conservation; and Mr. Richard Hazzard, Ms. Victoria Atchley, Mr. Craig Schmittler, and Mr. Alan McLuckie of the Illinois Natural History Survey, River Research Laboratory, Havana, IL.

Statistical analysis of data was completed by Mr. David Swofford, Illinois Natural History Survey, Champaign, IL.

We wish to thank the staff at the Illinois Department of Conservation Fisheries Headquarters, Havana, and especially Rudy Stinauer and Kenneth Hills for storing our diving boat; Mr. Mike Rhyner who arranged the loan of the Motorola Mini-Ranger III Radar Ranging System from the Upper Mississippi River Basin Association; Mr. Steve Harrison, Federal Aid Program Manager at the Illinois Department of Conservation; Mr. John Cookson, Chief of the State-Federal Relations Branch, National Marine Fisheries Service; and Ms. Sue Hale, grants and contracts officer, Natural History Survey, Champaign.

The following supplied us with equipment and parts and generally kept us running: Mr. Larry Gross and staff, Maintenance and Operations Section, Illinois Natural History Survey, Champaign; Mr. and Mrs. Bill Peters of Bill's Outboard and Repair, Canton, IL; Do Dive Inn, Inc. Bartonville, IL; Blue Hole Divers, Peoria, IL; and Getz Fire Equipment Company, Peoria, IL.

ABSTRACT

In June 1984, we collected 735 live mussels from the Illinois River in the vicinity of the Naples Terminal Company, Naples, IL, between river miles 62 and 67. We engraved an identification number on both valves, determined height and length, and noted any damage to the shells. We replaced marked mussels on the bottom in or near 1.5-m^2 aluminum corrals. Mussel corrals were grouped in two experimental (barge fleeting) plots and two control (no barges) plots. In October 1984, we resampled the plots. In one of the fleeted plots, barges are tied to pilings, and corrals in that plot were bowed and pushed into the substrate. In the other fleeted plot, barges are grounded, and the corrals had been destroyed. Corrals in the upstream control plot had been struck by propellers of small pleasure boats, while the downstream control corrals were unscathed. We recaptured 3 of 16 dead shells and 175 of 735 live mussels marked in June. In general, shell damage rates and mortality rates were higher in the fleeted plots than in the downstream control. Growth rates for most species were greater in the unfleeted downstream control than in the fleeted areas, and differences between plots were significant ($P \leq 0.055$) for Amblema plicata (the three-ridge) and Leptodea fragilis (the fragile paper shell). However, there were no other statistically significant differences, probably because of the small numbers of recaptures. Therefore, the trends for responses other than growth in two species must be considered inconclusive until we obtain larger samples of marked mussels and allow more time for damage, mortality, and growth to occur.

Sparks, Richard E., and K. Douglas Blodgett

EFFECTS OF FLEETING ON MUSSELS
Interim Report to the Illinois Department of Conservation and the National Marine Fisheries Service, August 1985

KEYWORDS--mussels/ Unionidae/ navigation/ navigation effects/ fleeting/ fleeting areas/ barges/ towboats/ terminals

INTRODUCTION

BACKGROUND

When this project began in 1982, the major objective was to determine the effects of barge fleeting on mussels. The need for such a study was, and remains, urgent because of the increase in the number of permit requests for fleeting areas. Proposed sites are primarily along the Mississippi and Illinois rivers just north of St. Louis, Missouri, although encroachment of river terminals and fleeting areas on mussel beds is a general problem on other navigable rivers. Because there are no data on effects of fleeting on mussel beds in rivers, permit seekers and hearing officers are free to conclude that there are no demonstrated effects. If barge fleeting does have adverse effects on mussels, then many mussel beds will be damaged in the future as more and more permits are issued.

A few examples give an idea of the magnitude and extent of the problem. New locks and a dam across the Mississippi River at Alton, Illinois are currently under construction, and traffic limitations caused both by the new construction and by limitations of the old lock have created a demand for fleeting areas in the vicinity. In addition, permits are being requested for new fleeting areas upstream in expectation of an increase in commercial navigation once the new locks are opened. In just one 10-mile reach of the Mississippi River (river mile 207- 217) there

were four permit requests for fleeting areas with a combined capacity of 240 barges (UMRCC 1982). A major commercial mussel bed is located in this area and at least one of the permits was opposed by the Illinois Department of Conservation and the U.S. Fish and Wildlife Service on environmental grounds, including possible damage to the mussel bed. Sixty-five miles upstream on a major tributary of the Mississippi River, the Illinois River, there are several mussel beds where Naples Terminal Company requested permits to fleet 563 barges. A request for expansion of a fleeting area in the east channel of the Mississippi River at Prairie du Chien, Wisconsin, has been embroiled in controversy because the Higgin's-eye pearly mussel (Lampsilis higginsi), an endangered species, occurs there (UMRCC 1983).

HISTORY OF THE PROJECT

The original grant-in-aid award was from 1 October 1982 to 30 September 1983 to survey one or more mussel beds in a reach of the Illinois River between river miles 51.2 and 54.3, where the Soyland Power Cooperative had been granted a permit to construct a barge unloading facility. The final product of the project was to include a detailed plan and cost estimate for a post-construction survey. The post-construction survey would have demonstrated any effects of barge fleeting on the mussel beds over five years. We believed funding for the post-construction surveys could have been

obtained from Soyland Power Company, the U.S. Army Corps of Engineers, or a consortium of fleeting companies.

When Soyland Power Cooperative decided not to build the power plant, because of declining demand for electricity, the project was extended and funding increased so that a new site could be located and another reconnaissance survey completed. In spring 1983, we selected the Naples Terminal Company at Illinois River miles 61.4-70.2 for our study site (Figure 1). In June 1983, we qualitatively sampled mussel beds in the area with a crowfoot bar. The crew then quantitatively sampled a bed which eventually would be heavily fleeted and another bed downstream which would not be fleeted. Our sampling locations were marked permanently by steel ground anchors whose exact positions could be determined by triangulation from two locations on shore.

We were not able to secure financial support beyond that provided by the National Marine Fisheries Service and the Illinois Department of Conservation, so we changed the design of the study to obtain results after only two summers of field work instead of the five summers originally envisioned. The new approach was a manipulative experiment where marked mussels were placed in both fleeted and unfleeted areas starting in spring 1984. The next section of the report gives details of the methodology and the following section describes project results through fall 1984. Results of the 1985 field work will be given in the project completion report in 1986.

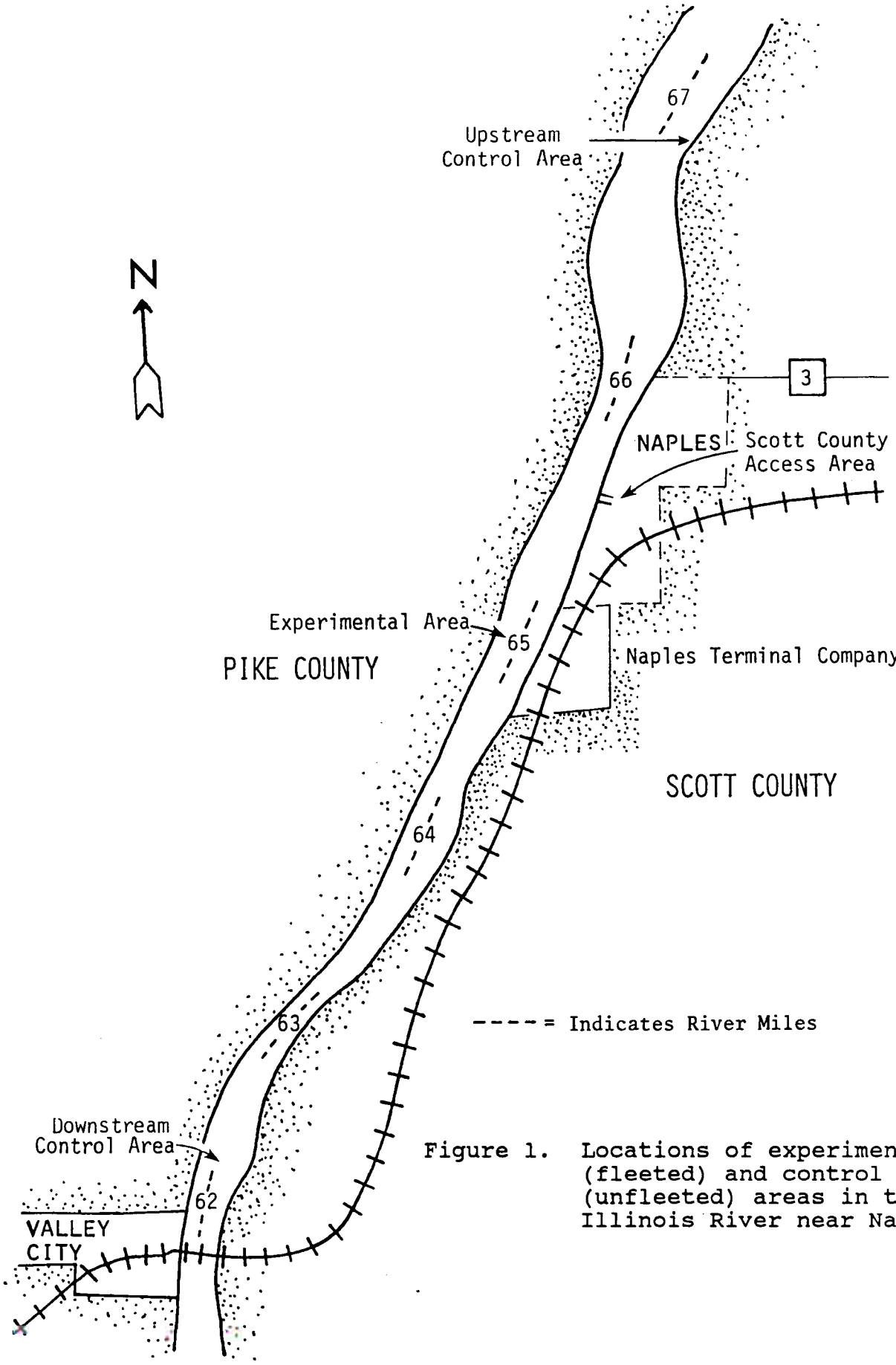


Figure 1. Locations of experimental (fleeted) and control (unfleeted) areas in the Illinois River near Naples.

Personnel, equipment, and travel money from the fleeting project also were used for emergency sampling on 27-30 June 1983 in pools 14 and 15 of the Mississippi River where a die-off of mussels had been reported by commercial clammers and state biologists. Results are reported in Appendix E of this report.

METHODS

LOCATING MUSSEL BEDS

Initially we used a brail (also called a crowfoot bar) to locate mussel beds in the fleeting area at Naples. The brail was 1.6 m long and had 30 4-pronged hooks or crowfeet attached to it. We fished the brail from a 6-m boat as the boat floated downstream with the current.

On 6 July 1983, we had great difficulty using the brail to identify mussel beds in the fleeting area. The hooks continually snagged on steel cables used for fleeting, submerged trees and brush, and even a discarded automobile. One day of brailing yielded only 12 mussels. On 12 July 1983, surface-supplied diving was used to reexamine plots within the fleeting area where a few mussels had been taken with the brail. An area on the west bank near river mile 65 had the greatest density of the plots investigated and was chosen for quantitative sampling by diving.

DIVING

For diving we used an 8-m pontoon boat equipped with an air compressor, primary and secondary storage banks, and a control console for air-pressure regulation and two-way communication to a diver using a US Divers' Superlite 17 diving helmet. In shallow

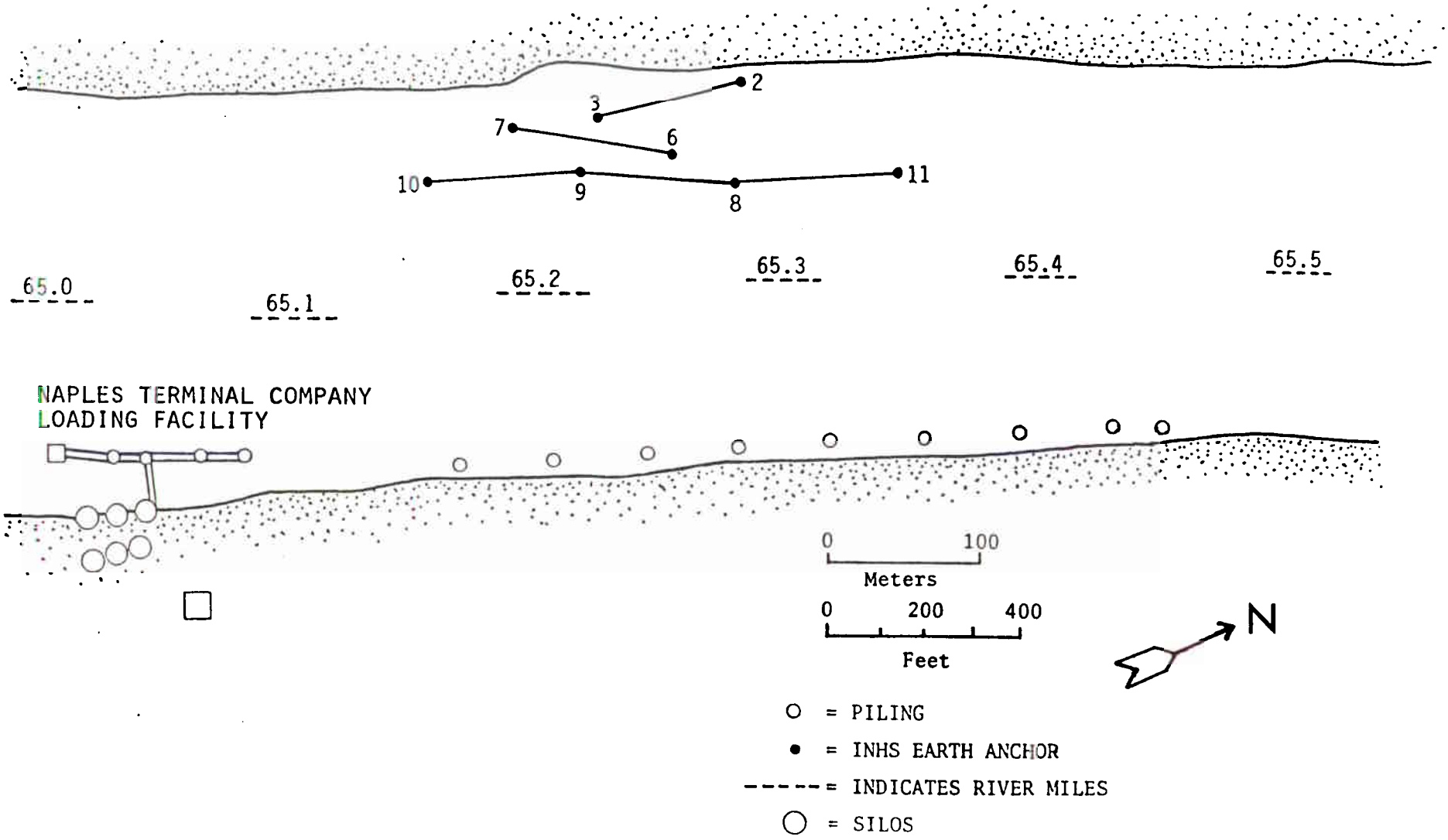
water we also waded and used self-contained underwater breathing apparatus (SCUBA).

PERMANENT SAMPLING TRANSECTS

In June 1984, five permanent transects were laid out and sampled in the fleeting site (Figure 2) and one transect in the control site (Figure 1) to determine whether mussel densities, species composition, size distribution, and shell damage initially differed between the fleeted and control sites. Permanent transects will allow us to relocate sampling points for long-term monitoring of the mussel beds after our short-term, manipulative experiment is completed.

To lay out a transect, the diver screwed a 1.2-m steel ground anchor, normally used to anchor house trailers against wind, into the bottom. He then attached one end of a 110-m rope to the anchor and a float to the opposite end. The float was allowed to move downstream in the current. The pontoon boat and diver then moved downstream to the float, and another anchor was set by the diver. Both upstream and downstream anchors were marked with additional floats. The diver identified individual ground anchors by the number of notches ground into the top of each one. We designated transects by the ground anchors that marked them. Thus, the transect running from ground anchor 3 to ground anchor 2 was transect 3-2 (Figure 2). Positions of the ground anchors were

Figure 2. Locations of permanent transects in the fleeting area on the Illinois River at Naples.



accurately determined by triangulation using a Motorola MiniRanger III so that we could relocate the anchors even after the floats were removed (Sparks and Blodgett, 1983).

The 1.3-cm diameter transect rope was marked at 1-m intervals for 100 m with pieces of smaller nylon cord. Ends of the small cord were knotted to allow the diver to determine each specific interval by touch. The diver placed a 1.0 x 0.5-m (0.5-m^2) sampling frame along an interval of the rope and collected all mussels within the frame. He then placed mussels from a single frame in a collection bag which was pulled up to the surface by personnel on the boat.

On the boat, the contents of the collection bag were transferred to a container and the bag returned to the diver. As the diver moved the frame and returned to sampling, the surface crew identified mussels to species, inspected them for damage, and measured shell height and length. Height was defined as the maximum dorso-ventral dimension of the shell at a right angle to the hinge including the ligament and any wing present and length as the maximum anterio-posterior dimension of the shell. Measurements were made to the nearest 0.001 inch (0.0025 cm) using a Helios dial caliper. Mussels were returned to the diver and either placed in the substrate in their normal position or simply dumped onto the substrate near their original location.

Mean densities and standard deviations were determined for each transect line and for all transects in the fleeting area combined.

STUDY PLOTS

Barges at the Naples Terminal Company are fleeted by one of two methods. Some are moved in against shore and attached by cables to cement deadmen located farther back on the shore. At least the inside edge of the barge nearest shore is grounded. We refer to this type of fleeting as grounding. The second method is to tie the barges to off-shore pilings in deep water. We identified four different study plots: two within the fleeting area to be used as experimental plots and two control plots outside the fleeting area. Thus mussels were exposed to one of three possible treatments:

1) control - no fleeting,

2) experimental - fleeting where barges are tied to pilings,

3) experimental - fleeting where barges are grounded.

Both fleeted plots were near river mile 65 (Figure 2). The first was on the west or right bank (facing downstream) where barges are grounded. The second was on the east or left bank where barges are secured to pilings. One control plot was approximately 4 km below the lower end of the fleeting area and close to the right bank near river mile 62, and the other was upstream on the left bank near river mile 67 (Figure 1).

MUSSEL CORRALS

Enclosures were constructed to facilitate recapture of marked mussels. Aluminum was used to make the enclosures strong, resistant to oxidation, and light enough to handle. Each was square and enclosed an area of 1.5 m^2. They could be pushed approximately 13 cm into the substrate to reduce the likelihood of mussels burrowing under them and extended approximately 8 cm above the substrate to keep mussels from climbing out.

Corrals were placed in groups of four or five. After the diver pushed each corral into the substrate, he wired it to at least one ground anchor. Accurate locations for each group of corrals were determined by triangulation.

COLLECTION AND MARKING OF MUSSELS

To collect mussels, the boat was anchored approximately 10 m upstream of the collection site. A diver entered the water and was directed to the upstream edge of the collection area by the crew on the surface. He then searched the substrate while moving to his left or right and maintaining tension on the umbilical line. This method allowed the diver to efficiently sample a 180^{o} arc a given distance downstream from the boat. When the surface crew determined the diver was approximately perpendicular to the current from the boat, they let out approximately 1 m of umbilical

hose and instructed him to sweep in the opposite direction. The diver sent mussels to the surface in collection bags.

On the boat, both valves of unmarked mussels were engraved with an identification number. To engrave shells we used a Dremel hand-held grinding tool powered by a 110-volt AC, gasoline-powered generator. Some dead shells were also engraved to determine whether dead shells would be washed out of the study area. After engraving, the mussels were identified to species, inspected for damage, and measured. Marked mussels were returned to corrals by the diver, with no more than 25 live mussels placed in a single enclosure. Additional marked mussels were placed outside the corrals by dumping them into the water from the surface or by the diver scattering them along the bottom.

SPECIES STUDIED

Mussels could respond to fleeting in different ways because of interspecific differences in physiology, morphology, and behavior. We intended to use one relatively thick-shelled species, Amblema plicata (the three-ridge), and one thin-shelled species, Leptodea fragilis (the fragile papershell). We were unable to collect sufficient numbers of Leptodea fragilis, so we supplemented them with another fragile-shelled species Proptera laevissima (the fragile heelsplitter). We also collected and marked other species as time permitted. A list of scientific and

common names of mussel species used in this research is provided in Appendix A.

EFFECTS MEASURED

Shell Damage

We considered mussels damaged if either valve showed chips, cracks, and scrapes we felt were unnatural. What appeared to be gradual wearing away of a valve near the umbones, due to scour or the normal burrowing of the animal, was called erosion and was not considered damage. Similarly, dents in the shells of the fragile-shelled species were not considered damage.

Damage rates were calculated as percentages by dividing the number of damaged mussels by the total number of mussels taken.

Mussels collected in 1984 were divided into two categories for analysis of damage: those which were collected for the first time, and those which were recaptured. Shells of newly-captured mussels recorded damage accumulated during their adult life span in the area in which they were found. Shells of recaptured mussels recorded damage accumulated between the time they were marked and the time they were recaptured (spanning the summer of 1984 in this study) in the area in which they were placed.

According to spokesmen from Naples Terminal Company, heaviest fleeting activity occurs between fall and spring rather than in summer. In fall and winter, farmers harvest grain which is shipped downriver to New Orleans. In winter and early spring,

fertilizer is brought upriver for distribution to farmers. The river seldom is closed to barge traffic by ice. Hence, our results represent effects of a seasonal minimum in fleeting activity.

Mortality

Mortality rates were calculated as percentages by dividing the number of recaptures that had died between samplings by the total number of recaptures.

Dead shells were marked in order to develop a correction factor for mortality rates. A marked mussel which dies during the interval between recaptures may be more likely to be washed out of the study plot or buried beneath sediment than a live mussel which maintains itself in the substrate at the sediment-water interface. A mortality rate based on the number of marked shells found dead since last being captured thus underestimates the actual mortality if dead shells are less likely to be recaptured than live mussels.

Comparison of mortality rates between plots assumes the probability of recovery of dead shells is the same for each plot. However, mortality rates are more likely to be underestimated in the fleeted plots, where prop wash displaces dead shells, than in control plots. Light, fragile shells are more likely to be displaced than heavy shells. Therefore, separate correction

factors for mortality should be developed for each species in both fleeted and unfleeted plots.

Growth

Growth rates are reported as increase in shell length in centimeters per month. Mussels that were already damaged when initially found and those that died before recapture were not used in analyses of growth.

STATISTICAL ANALYSES

Four types of statistical tests were used to determine whether there were significant differences in shell damage, mortality, and growth rates in mussels recaptured from fleeted and unfleeted areas. We used Fisher's exact test (2-tail) to determine if mortality and damage were independent of "treatment", that is, exposure to fleeting or no exposure to fleeting. Because of the small sample sizes, data for the two fleeted plots were pooled for this analysis. Each individual recaptured was either alive or dead, and the shells were classified as either damaged or undamaged. We also analyzed damage and mortality in all four plots using chi-square tests of independence.

For analysis of growth we employed a one-way ANOVA keeping the four treatments separate (upstream control, downstream control, pilings, and grounded barges). Variances were

tested to determine whether to use a conventional ANOVA (variances assumed equal) or a Brown-Forsythe ANOVA (variances not assumed to be equal). The ANOVA indicates whether there are significant difference between treatments without indicating which of the four treatments differ from each other. Hence, we used Tukey's studentized range test to make pairwise comparisons of each treatment to the others.

Statistical analyses were limited by small sample size. In some cases there were insufficient degrees of freedom for the test, or there were entire rows or columns in the contingency tables with no values so that expected frequencies could not be computed. We have presented statistical analyses for the four species with the greatest number of individuals and, where appropriate, for all species combined.

RESULTS AND DISCUSSION

MUSSEL DENSITIES IN FLEETED AND UNFLEETED AREAS

We quantitatively sampled a total of 274 0.5-m^2 quadrats along five transects in the fleeting site (Figure 2). Results for each transect are presented in Appendix B. Densities in samples ranged from 0 to 44 live mussels/m^2. Mean densities (with standard deviations) were calculated for each transect (Table 1) and were extremely variable. Mean transect densities (and standard deviations) in the fleeting area ranged from 1.28 ($\pm$ 2.48) to 13.24 ($\pm$ 10.06) mussels/m^2, with an overall mean of 7.10 ($\pm$ 8.62).

Seventy-seven 0.5-m^2 samples were collected along one transect in the downstream control area (Figure 1). Data for each transect are listed in Appendix B and summarized in Table 1. Densities ranged from 0 to 32 live mussels/m^2, and the mean density (and standard deviation) was 11.46 ($\pm$8.56). There were more live mussels/m^2, on average, in the unfleeted control area than in the fleeted area. Variances were approximately equal in the two areas.

EFFECTS OF BOATS ON MUSSEL CORRALS AND SUBSTRATE

We placed 24 mussel corrals in June 1984 (Table 2). When we returned in October 1985, and tried to locate the corrals placed in the experimental plot where barges had been grounded, we found

Table 1. Numbers of live mussels obtained along six transects in fleeted and unfleeted areas of the Illinois River at Naples.

	Transect	No. of 0.5m^2 Samples	No. Live Mussels	No./0.5 m^2 (No./m^2)	S.D.
Control Area (not to be fleeted)	5-4	77	441	5.73 (11.46)	4.28
Experimental Area (to be heavily fleeted)	3-2	75	159	2.12 (4.24)	2.50
	7-6	50	32	0.64 (1.28)	1.24
	9-8	50	223	4.46 (8.92)	4.57
	10-9	49	229	4.67 (9.34)	4.82
	8-11	50	331	6.62 (13.24)	5.03
Total, Experimental Area	5 transects	274	974	3.55 (7.10)	4.31

Table 2. Numbers of mussel corrals placed in fleeted and unfleeted study plots in the Illinois River at Naples.

Plot	Number of Corrals
Fleeted - Grounded	13
Fleeted - Pilings	4
Control - Upstream	4
Control - Downstream	4
Total	25

pieces from less than three. Gashes in the aluminum sheet metal and reinforcing angle indicated that the corrals had been struck by propellers. Most of the pieces were bent and crumpled. There were several 1-2m-deep pits in the substrate which we believe were created by prop wash. We have observed towboats working as long as three hours to pull a grounded barge off the shore. When a towboat operates at full throttle in one place in shallow water, it undoubtedly scours away the bottom. Sand and mud were probably washed away from our ground anchors and the aluminum corrals subsequently drawn into the props, or props may have actually struck the substrate and our corrals. Prop wash probably scattered and buried some of our marked mussels.

We found all the corrals near the pilings. The diver said the top edges of the corrals were bent over and had either been covered with sediment to a depth of 20 cm or pushed down into the mud. A barge evidently settled on the corrals during low water or had been pushed over the corrals.

Corrals in the upstream control plot had been damaged, apparently by smaller propellers. Debris and a campsite left on the bank indicated that the area was used heavily by recreational boaters during the summer. Corrals in the downstream control plot were intact and slightly silted in on their upstream edge.

MUSSELS MARKED AND RECAPTURED

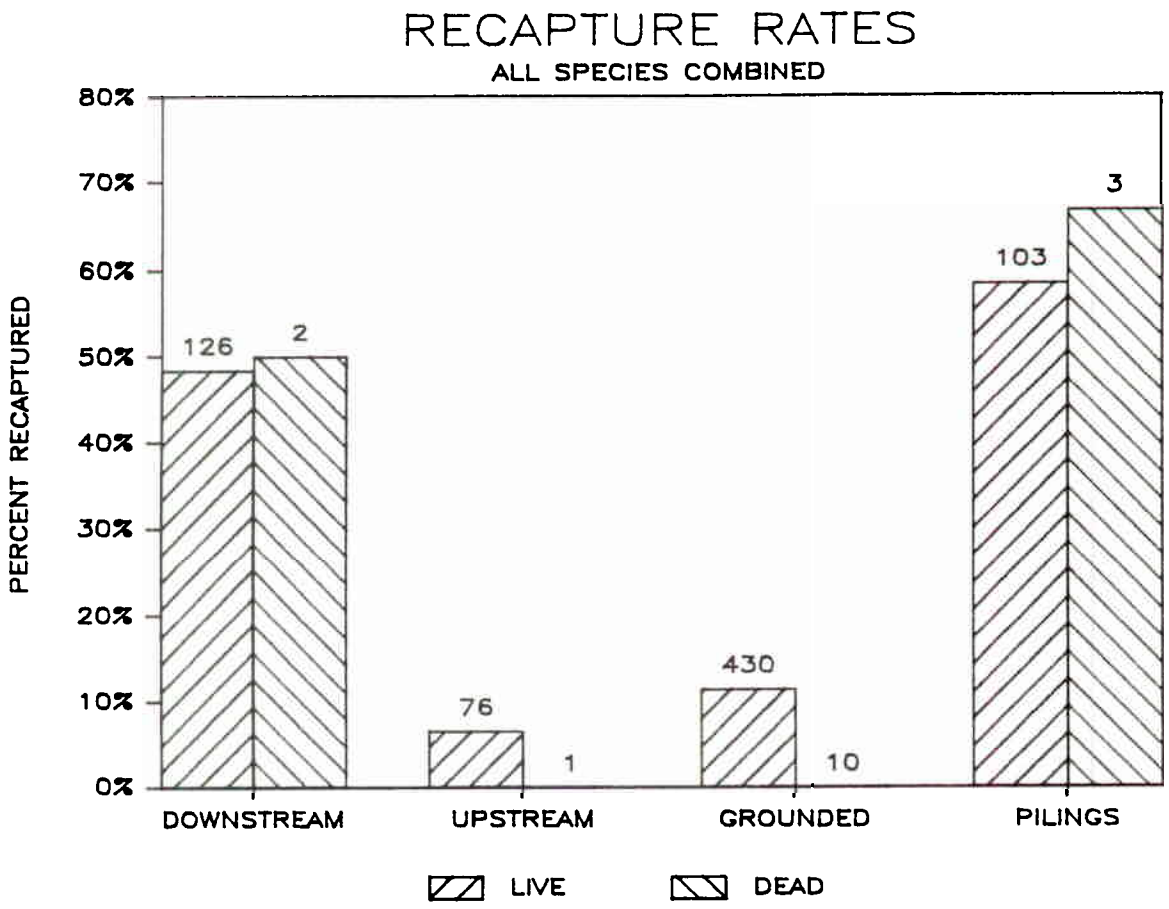
During June 1984, we collected, marked, and replaced a total of 735 live and 16 dead mussels in the two experimental and two control plots (Table 3). Data for all mussels marked in 1984 are presented in Appendix C.

In October 1984, we recaptured 3 of the 16 dead shells and 172 of 735 live shells we had marked in June (Table 3). Data for recaptured mussels are presented in Appendix D. We also collected and marked 740 live, previously unmarked shells, so that the total number of live, marked mussels replaced in the study area in 1984 was 1,475 (Appendix C). Although the recapture percentage for mussels which were alive when marked (23.8%) was higher than that for shells which were dead when marked (18.4%), we feel the sample of dead shells was too small to assert that once a marked mussel dies it is less likely to be found than one which remains alive. We are now marking more dead shells to determine correction factors for mussel mortality.

Recapture rates for live mussels were relatively high in the piling plot (58.3%) and the downstream control (48.4%) (Figure 3). High recovery rates were due, in part, to intact corrals restricting movements of mussels and facilitating sampling by the diver. Unrecovered mussels may have escaped from enclosures by burrowing or climbing out where siltation had occurred, been moved by currents, or, in the case of mussels placed outside corrals, been missed by the diver. Recovery rates where barges were

Table 3. Numbers of live and dead mussels marked and recaptured from fleeted and unfleeted plots in the Illinois River at Naples.

Plot	Marked		Recaptured		Percent Recaptured	
	Live	Dead	Live	Dead	Live	Dead
Fleeted-Grounded	430	10	49	0	11.4	0.0
Fleeted-Pilings	103	3	60	2	58.3	66.7
Fleeted-Subtotal	533	13	109	2	20.5	15.4
Control-Upstream	76	1	5	0	6.6	0.0
Control-Downstream	126	2	61	1	48.4	50.0
Control-Subtotal	202	3	66	1	32.7	33.3
All Plots - Total	735	16	175	3	23.8	18.8



Note: Numbers at the top of bars indicate the total number of live mussels marked and placed in the plot in 1984.

DOWNSTREAM = unfleeted, downstream control plot

UPSTREAM = unfleeted, upstream control plot

GROUNDED = fleeted plot, barges against shore

PILINGS = fleeted plot, barges tied to pilings

Figure 3. Recapture rates for live and dead mussels recaptured from fleeted and unfleeted plots in the Illinois River at Naples.

grounded and in the upstream control plot were much lower, 11.4% and 6.6% respectively. As previously noted, corrals in both of these areas were destroyed.

PROBLEMS WITH SMALL SAMPLE SIZES

We found no statistically significant differences ($P \leq 0.050$) in shell damage and mortality of mussels from the four plots (Table 4). When data from the two fleeted plots were pooled and compared to the downstream control, the P value for mortality in Amblema plicata was 0.096 and for shell damage in all species pooled was 0.074--none of the other values were close to 0.05. Sample sizes were small, and in fact no damaged Leptodea fragilis were recovered. Mussels with heavy shells, such as Amblema plicata, are scraped and pushed down in the mud when barges are grounded on them. We believe fragile-shelled species are crushed to pieces. Since divers did not recover small shell fragments (even if they had the particular fragment with the number on it might not have been recovered), our results probably underestimate the number of fragile-shelled species damaged or killed. With larger sample sizes, between-plot differences in damage and mortality of heavier-shelled species are more likely to be significant.

Shell growth rates differed between plots for Amblema plicata, the species with the largest sample size (Table 5). The P value for Leptodea fragilis, the species with the next largest

Table 4. Probability (P) values for contingency tests comparing shell damage and mortality of mussels from fleeted and unfleeted plots in the Illinois River at Naples.

	Fisher's Exact Test 2 x 2 (pooled fleeted vs. downstream control)			Chi-Square 2 x 4 (unpooled)		
	Damage	Mortality	n	Damage	Mortality	n
Amblema plicata	0.231	0.096	112	0.473	0.101	116
Leptodea fragilis	na	1.000	15	na	1.000	15
Proptera laevissima	0.152	1.000	11	0.151	0.325	12
Quadrula pustulosa	1.000	1.000	14	0.584	0.588	14
All species pooled	0.074	0.383	157	0.189	0.248	172

na - not applicable, no damaged shells recovered

Table 5. Probability (P) values (of type I error) for a 1-way ANOVA (Brown-Forsythe) comparing growth rates (shell length) of mussels from two fleeted and two unfleeted plots in the Illinois River at Naples.

	P	n	Plots
Amblema plicata	0.006	109	d,u,g,p
Leptodea fragilis	0.055	14	d,p
Proptera laevissima	0.445	8	d,p
Quadrula pustulosa	0.584	11	d,g,p

d - unfleeted, downstream control
u - unfleeted, upstream control
g - fleeted, barges grounded
p - fleeted, barges tied to pilings

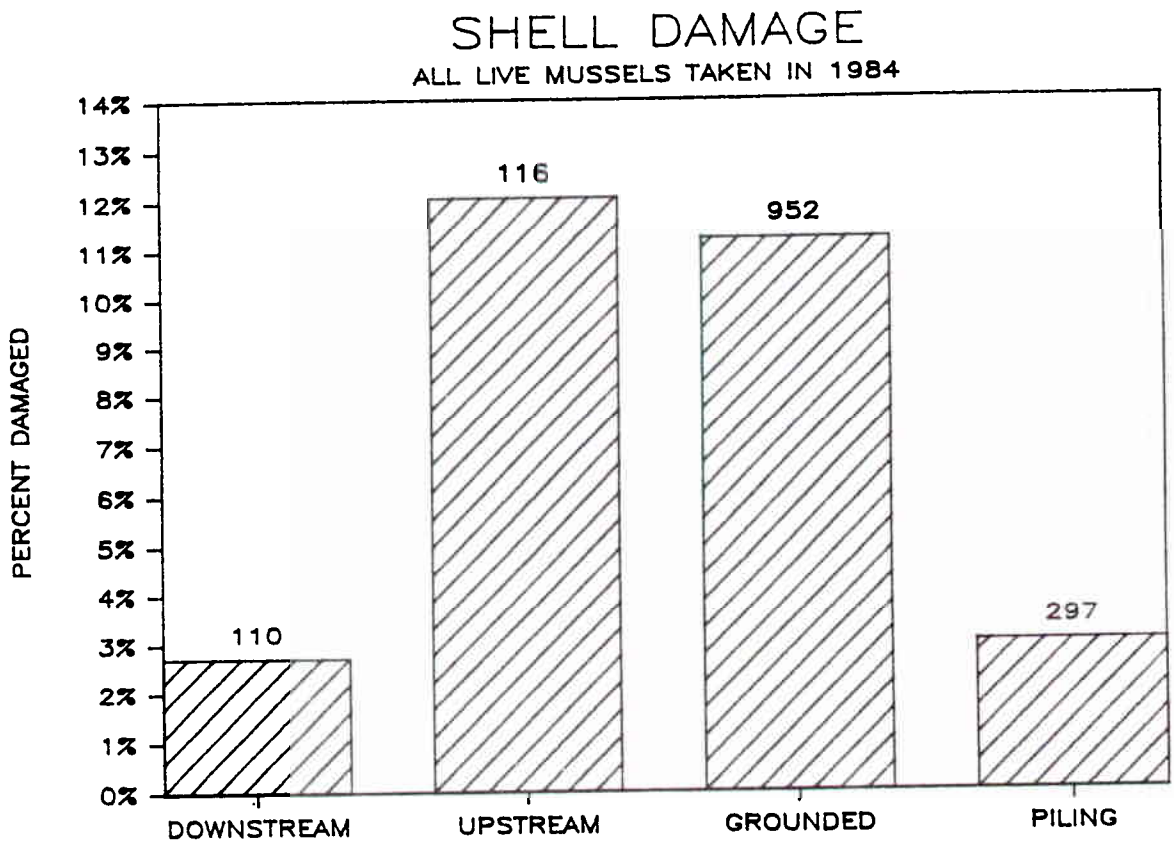
sample size, was 0.055. Although the ANOVA test detected differences between plots, paired comparisons and multiple range tests could not detect which of the plots differed from each other, again, because of the low power associated with small sample sizes.

In summary, while there was a significant difference in growth rates between plots for Amblema plicata and while trends are evident for other effects (mortality and damage) and other species, results must be considered inconclusive until we obtain larger samples of marked mussels and allow more time for growth, damage, and mortality to occur. The additional sampling in 1985, and any subsequent sampling, will increase the number of recaptures and enable us to draw more definitive conclusions.

With the above cautions in mind, we next present graphs showing trends in shell damage, mortality and growth rates of Amblema plicata, the species with the most data, and, where appropriate, all species pooled. In general, most of the other species showed similar trends. Since only five marked mussels were recaptured from the unfleeted upstream control, they were not included in the graphs of recapture data.

SHELL DAMAGE IN MUSSELS COLLECTED FOR THE FIRST TIME

The highest damage rate (14 of 116 live mussels, 12.1%) was in the upstream, unfleeted control plot (Figure 4). None of the 41 mussels initially collected at the upstream control in spring



Note: Numbers at the top of bars indicate the total number of live mussels collected from the plot in 1984.

DOWNSTREAM = unfleeted plot, downstream control

UPSTREAM = unfleeted plot, upstream control

GROUNDED = fleeted plot, barges against shore

PILING = fleeted plot, barges tied to pilings

Figure 4. Shell damage rates for all live mussels collected in 1984 from fleeted and unfleeted plots in the Illinois River at Naples.

1984 were damaged. All the damaged mussels (14 of 75 - 18.7%) collected at the plot were found in fall after use of the area by recreational boaters.

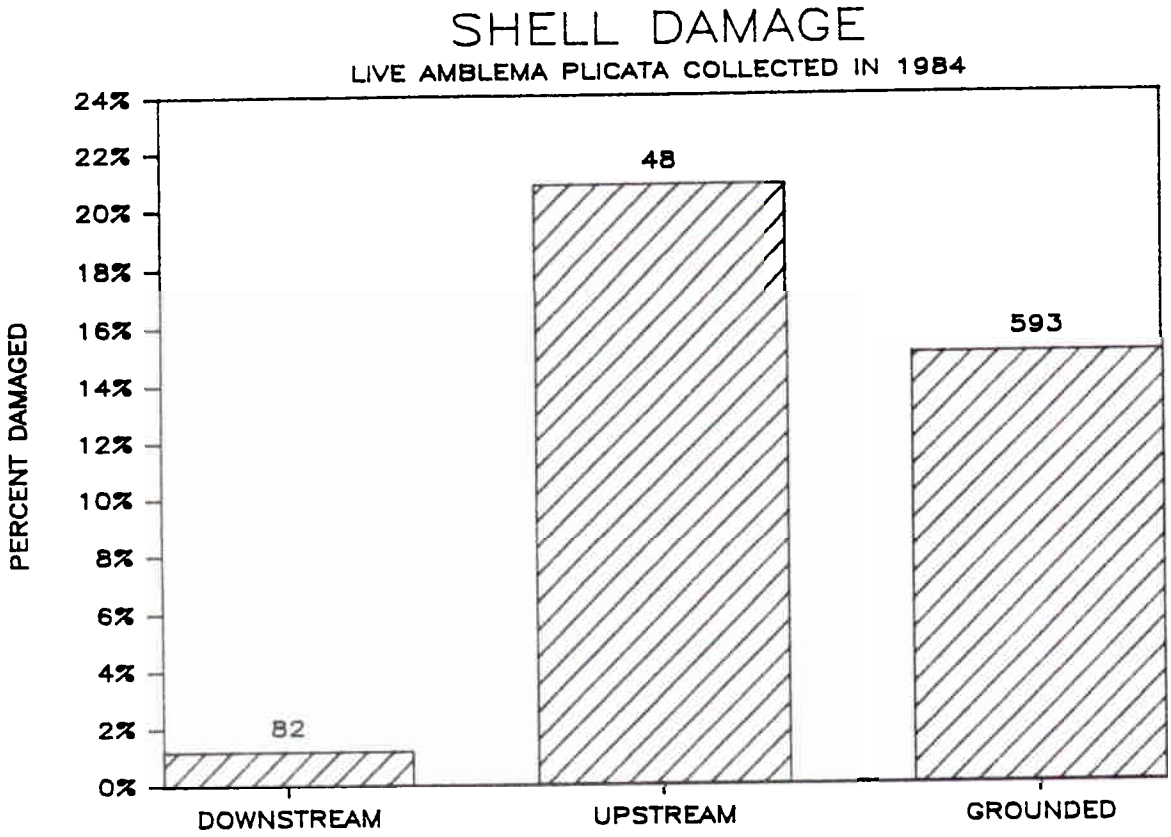
The next highest damage rate was in the grounded plot where 107 of 952 (11.2%) mussels collected in 1984 were damaged. The spring rate was 4.5% (17 of 374) and the fall rate was 15.6% (90 of 578).

The spring damage rate for the plot where barges were attached to pilings was 2.7% (7 of 264), the fall rate was 6.1% (2 of 33), and the total rate was 3.0% (9 of 297). We presume that rates were relatively low in the piling plot because barges were usually in water deep enough to keep them from contacting the bottom and the mussels.

The lowest overall damage rate of 2.7% (3 of 110) was in the downstream control. The spring rate there was 1.8% (1 of 46) and the fall rate was 3.7% (2 of 54).

In every plot, the percentage of damaged mussels was greater in the fall 1984 collection than in the spring 1984 collection, indicating that a detectable amount of additional damage was being done in a period as short as 3.5 months.

Data for Amblema plicata, the most abundant species, showed a similar trend (Figure 5). Highest damage rates were in the upstream control (20.8%) and grounded plots (15.0%). The lowest damage rate (1.2%) was in the downstream control plot. We collected no unmarked Amblema plicata in the piling plot.



Note: Numbers at the top of bars indicate the total number of live Amblema plicata collected from the plot in 1984.

DOWNSTREAM = unfleeted plot, downstream control

UPSTREAM = unfleeted plot, upstream control

GROUNDED = fleeted plot, barges against shore

Figure 5. Shell damage rates for live Amblema plicata collected in 1984 from fleeted and unfleeted plots in the Illinois River at Naples.

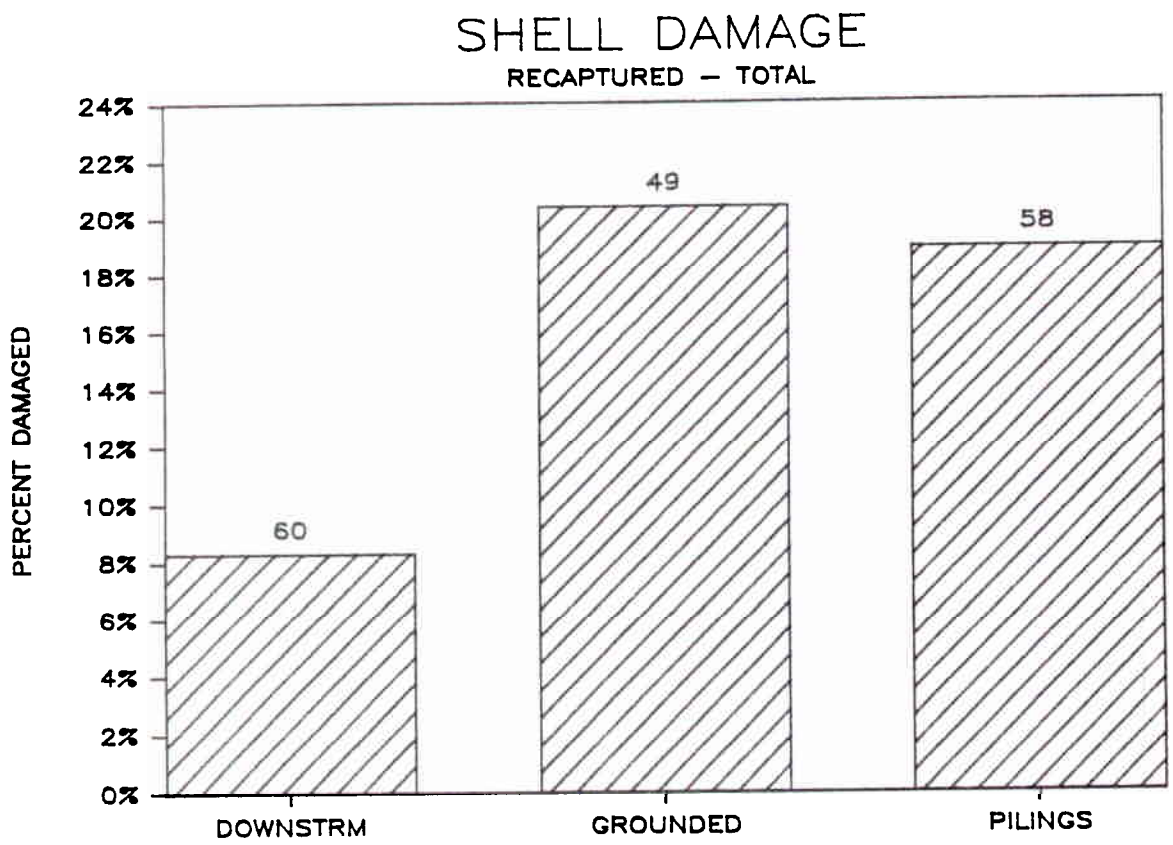
SHELL DAMAGE IN RECAPTURED MUSSELS

The same trends are apparent for new damage to marked mussels which occurred between the times mussels were collected and marked in spring and recaptured in fall. With all species combined, the highest damage rates were from the fleeted plots (20.4% in the grounded plot and 19.0% in the pilings) (Figure 6). Again the lowest damage rate (8.3%) was in the downstream control. Only five marked shells were recaptured from the upstream control plot. Results for Amblema plicata were similar (Figure 7).

MORTALITY

With all species combined, the highest mortality rate (13.8%) was in the pilings (Figure 8). Rates in the grounded and downstream control plots were 6.1% and 5.0% respectively.

Again, low numbers of recaptured individuals made it difficult to draw conclusions from the mortality rates for individual species. Data from 116 recaptured Amblema plicata (only four marked Amblema plicata were recaptured from the upstream control) showed higher mortality rates in the fleeted plots than in the downstream control with the highest rate (13.5%) from the piling plot (Figure 9). While the bottom was more disturbed in the grounded plot, the piling plot tended to



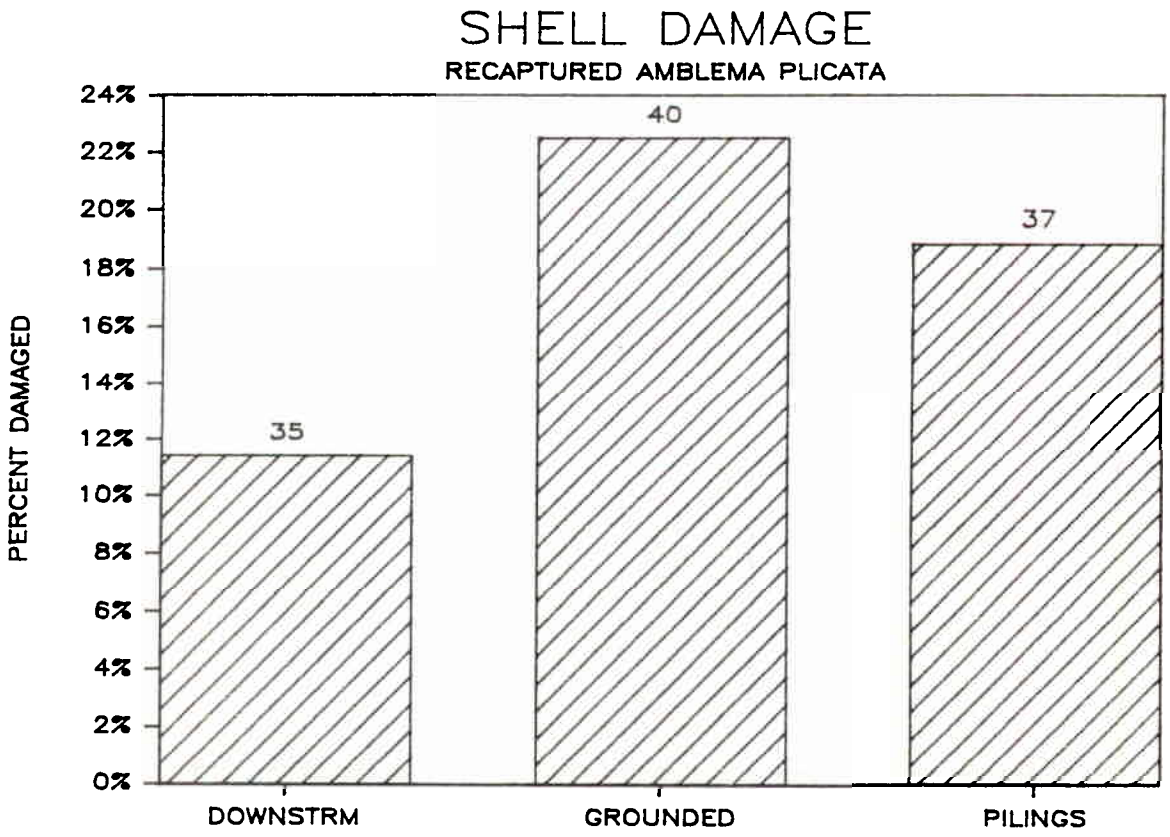
Note: Numbers at the top of bars indicate the total number of marked mussels recaptured at the plot in 1984.

DOWNSTRM = unfleeted plot, downstream control

GROUNDED = fleeted plot, barges against shore

PILINGS = fleeted plot, barges tied to pilings

Figure 6. Shell damage rates for all mussels recaptured from fleeted and unfleeted plots in the Illinois River at Naples.



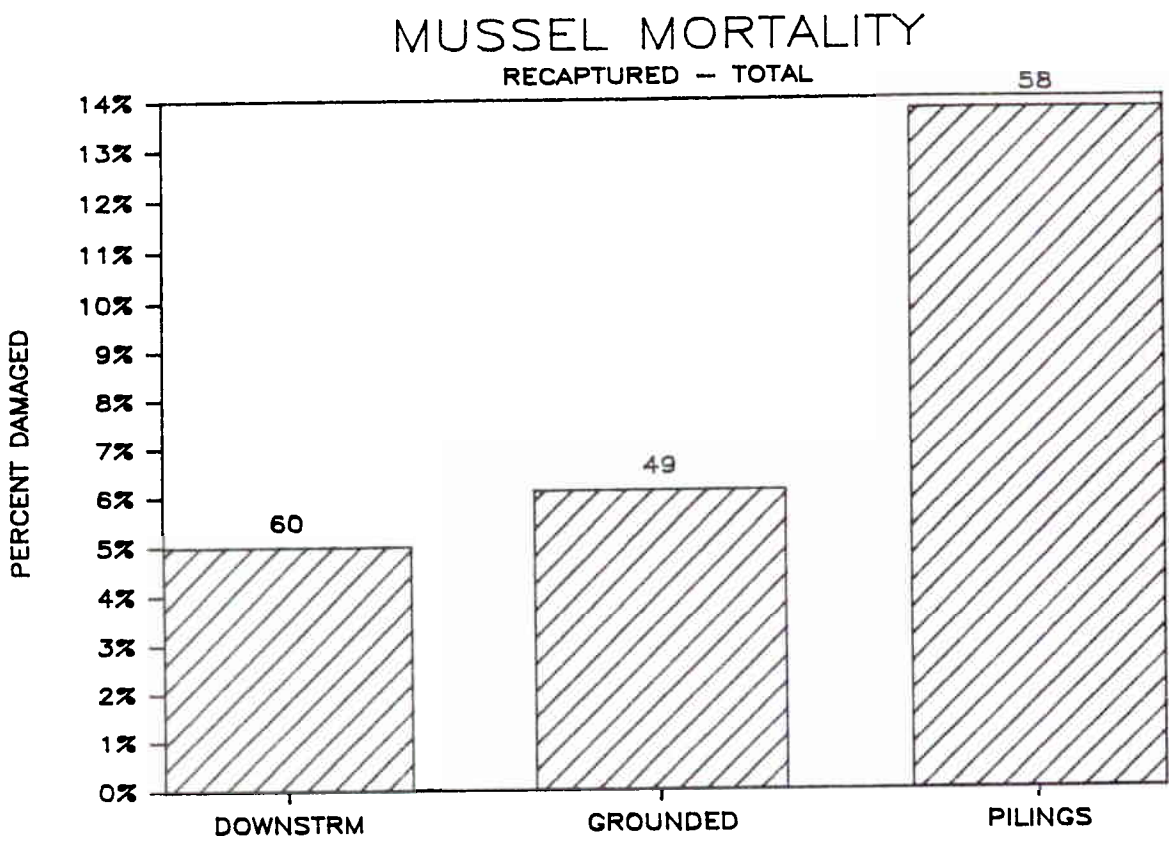
Note: Numbers at the top of bars indicate the total number of recaptured Amblema plicata which were alive when placed in the plot in 1984.

DOWNSTRM = unfleeted plot, downstream control

GROUNDED = fleeted plot, barges against shore

PILINGS = fleeted plot, barges tied to pilings

Figure 7. Shell damage rates for Amblema plicata recaptured from fleeted and unfleeted plots in the Illinois River at Naples.



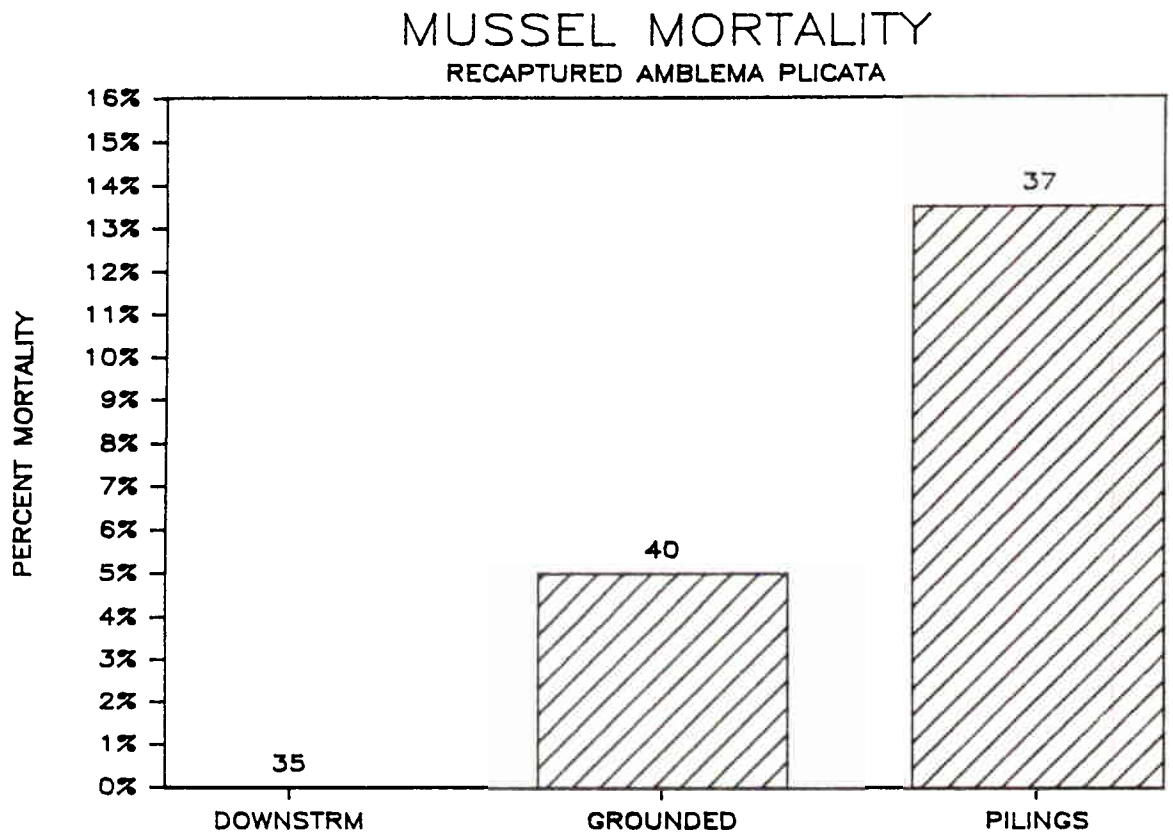
Note: Numbers at the top of bars indicate the total number of marked mussels recaptured at the plot in 1984.

DOWNSTRM = unfleeted plot, downstream control

GROUNDED = fleeted plot, barges against shore

PILINGS = fleeted plot, barges tied to pilings

Figure 8. Mortality rates for mussels recaptured from fleeted and unfleeted plots in the Illinois River at Naples.



Note: Numbers at the top of bars indicate the total number of marked Amblema plicata recaptured at the plot in 1984.

DOWNSTRM = unfleeted plot, downstream control

GROUNDED = fleeted plot, barges against shore

PILINGS = fleeted plot, barges tied to pilings

Figure 9. Mortality rates for Amblema plicata recaptured from fleeted and unfleeted plots in the Illinois River at Naples.

have barges fleeted there a greater percentage of the time. When we sampled the piling plot in October, the diver could not get under the barge to the corrals, and the Naples Terminal Company moved the barge for us. As previously mentioned, it appeared that a barge had settled on top of the corrals and mussels, and mussels may have suffocated. No fragile-shelled mussels (Leptodea fragilis or Proptera laevissima) were recaptured at the grounded plot.

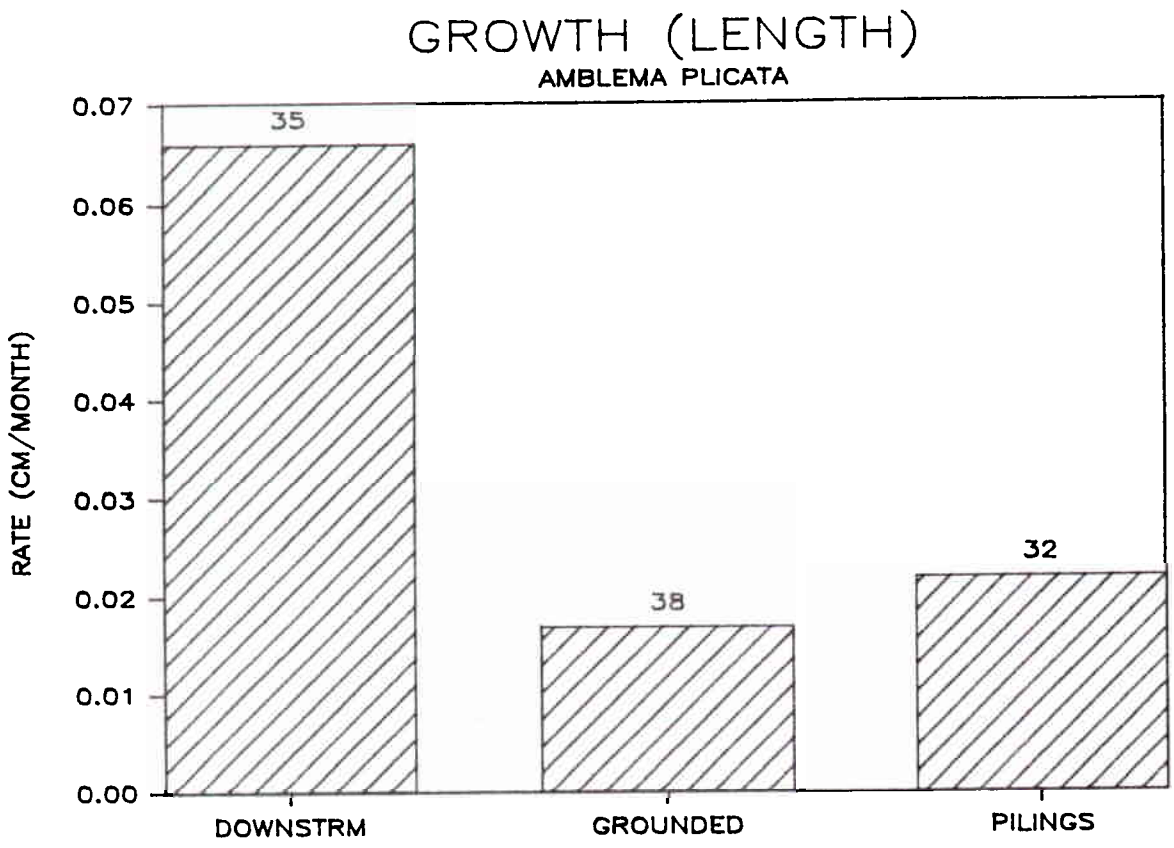
In the downstream control plot, only three recaptured experimental mussels, one Leptodea fragilis and two Proptera laevissima, had died between June and October. We have noticed these two species suffer higher mortality in handling and in aquaria at our laboratory than Amblema plicata, so they may be more sensitive to handling stress or water quality factors. As previously mentioned, comparatively low mortality rates in the fleeted plots could be an artifact of displacement of dead fragile-shelled species.

GROWTH

Growth rates are usually greater in younger mussels of a given species. To adequately compare growth rates of individuals from different treatment plots, it is necessary to collect enough individuals of different ages from each plot to construct growth curves. At present we do not have enough data to delineate these

growth curves. The following interpretation of growth rates for Amblema plicata, the most frequently recaptured species (116 recaptures), is based on available data and does not account for differences in mean size and age of mussels from different plots.

Growth rates for Amblema plicata were greater in the downstream control plot than in either of the fleeted plots (Figure 10). Both growth and mortality rates for this species were greater in the pilings (0.022 cm/month, 13.5%) than in the grounded plot (0.017 cm/month, 5.0%).



Note: Numbers at the top of bars indicate the total number of live, undamaged, marked Amblema plicata recaptured at the plot in 1984.

DOWNSTRM = unfleeted plot, downstream control

GROUNDED = fleeted plot, barges against shore

PILINGS = fleeted plot, barges tied to pilings

Figure 10. Growth rates (shell length) of Amblema plicata between June and October in fleeted and unfleeted plots in the Illinois River at Naples.

SUMMARY

1. This is an interim report on a continuing study of effects of barge fleeting on mussels in the Illinois River at Naples, Illinois. Results will be used to evaluate requests for fleeting permits where proposed fleeting sites and mussel beds overlap.

2. In June 1984, we collected, marked, and replaced 735 live and 16 dead mussels in two experimental (fleeted) and two control (unfleeted) plots. In one fleeted plot barges were tied to pilings, and in the other barges were tied to deadmen and grounded along shore. Mussels were placed in 25 aluminum corrals up to normal densities, and additional mussels placed around the corrals.

3. In October 1984, we recaptured 3 of 16 dead shells and 175 of 735 live mussels. We also collected and marked 740 live, previously unmarked mussels bringing the total number of live, marked mussels in the study area at the end of 1984 to 1475.

4. Corrals in the area where barges were grounded were destroyed and remaining pieces had obviously been struck by large propellers. There were several 1-2-m deep pits in the substrate which may have been created by prop wash. Corrals by the pilings were bowed and pushed into the substrate but otherwise intact. Corrals at the upstream control site had been struck by small

propellers, probably pleasure boats which were beached at an adjacent campsite. Corrals at the downstream control were untouched.

5. In general, shell damage rates and mortality rates were higher in the fleeted plots than in the downstream control, but none of the differences were significant ($P \leq 0.055$) with the small sample size available. At the unfleeted upstream control plot, none of the 41 mussels collected in June were damaged. In fall, after summer use of the area by recreational boaters, 14 of 75 mussels collected were damaged.

6. Growth rates for most species were greater in the unfleeted downstream control than in the fleeted areas. Differences between plots were significant ($P \leq 0.055$) for the most frequently recaptured species, Amblema plicata and Leptodea fragilis, but not for any other species.

7. Any effects of fleeting on mussels were probably at seasonally minimal levels during our study. Fleeting activity reaches a low during summer according to spokesmen for Naples Terminal Company. Therefore, these trends must be considered inconclusive until we obtain larger samples of marked mussels and allow more time for damage, mortality, and growth to occur.

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APPENDICES

Appendix A. Scientific and common names and species codes for all live mussel species taken in 1984 from the Illinois River near Naples.

Scientific Name	Species Code	Common Name
Fusconaia flava	FF	Pig-toe
Megalonaias gigantea	MG	Washboard
Amblema plicata	AP	Three-ridge
Quadrula quadrula	QQ	Maple-leaf
Quadrula pustulosa	QP	Pimple-back
Quadrula nodulata	QN	Warty-back
Arcidens confragosus	AC	Rock pocketbook
Lasmigona complanata	LC	White heel-splitter
Anodonta grandis	AG	Floater
Anodonta imbecillis	AI	Paper pond shell
Obliquaria reflexa	OR	Three-horned warty-back
Truncilla truncata	TT	Deer-toe
Truncilla donaciformis	TD	Fawn's foot
Leptodea fragilis	LF	Fragile paper shell
Proptera alata	PA	Pink heel-splitter
Proptera laevissima	PL	Fragile heel-splitter
Lampsilis teres	LT	Sand-shell

Appendix B. Results of 1983 quantitative sampling.

Table B1.
Numbers of live mussels and clams taken in 75 0.5-m^2 samples on transect 3-2 from the fleeted area of the Illinois River at Naples.

	Total	Mean per 0.5 m^2	S.D.	No. of Samples in which species occurred	Percent occur-rence
Fusconaia flava					
Megalonaias gigantea	1	0.013	0.115	1	1.3
Amblema plicata	96	1.280	1.681	43	57.3
Quadrula quadrula	15	0.200	0.465	13	17.3
Quadrula pustulosa	30	0.400	0.717	24	32.0
Quadrula nodulata	5	0.067	0.251	5	6.7
Arcidens confragosus					
Lasmigona complanata					
Anodonta grandis					
Anodonta imbecillis					
Obliquaria reflexa	2	0.027	0.162	2	2.7
Truncilla truncata					
Truncilla donaciformis	3	0.040	0.197	3	4.0
Leptodea fragilis	5	0.067	0.251	5	6.7
Proptera alata	1	0.013	0.115	1	1.3
Proptera laevissima	1	0.013	0.115	1	1.3
Lampsilis teres					
Unidentified					
Total Mussels	159	2.120	2.504	50	66.7
Musculium transversum	1	0.013	0.115	1	1.3
Corbicula fluminea	126	1.680	3.939	23	30.7

Appendix B continued.

Table B2.
Numbers of live mussels and clams taken in 77 0.5-m^2 samples on transect 5-4 from the unfleeted area of the Illinois River at Naples.

	Total	Mean per 0.5 m^2	S.D.	No. of Samples in which species occurred	Percent occur-rence
Fusconaia flava	1	0.013	0.114	1	1.3
Megalonaias gigantea	10	0.130	0.375	9	11.7
Amblema plicata	151	1.961	2.268	52	67.5
Quadrula quadrula	41	0.532	0.680	33	42.9
Quadrula pustulosa	27	0.351	0.602	22	16.9
Quadrula nodulata	10	0.130	0.375	9	11.7
Arcidens confragosus	3	0.039	0.195	3	2.3
Lasmigona complanata					
Anodonta grandis	1	0.013	0.114	1	1.3
Anodonta imbecillis	1	0.013	0.114	1	1.3
Obliquaria reflexa	20	0.260	0.548	16	20.8
Truncilla truncata	14	0.182	0.556	9	11.7
Truncilla donaciformis	154	2.000	2.077	54	70.1
Leptodea fragilis	4	0.052	0.223	4	5.2
Proptera alata	1	0.013	0.114	1	1.3
Proptera laevissima	2	0.026	0.160	2	2.6
Lampsilis teres					
Unidentified	1	0.013	0.114	1	1.3
Total Mussels	441	5.727	4.285	68	88.3
Musculium transversum	563	7.312	13.303	58	75.3
Corbicula fluminea	2931	38.065	32.452	76	98.7

Appendix B continued.

Table B3.
Numbers of live mussels and clams taken in 50 $0.5m^2$ samples on transect 6-7 from the fleeted area of the Illinois River at Naples.

	Total	Mean per $0.5\ m^2$	S.D.	No. of samples in which species occurred	Percent occurrence
Fusconaia flava					
Megalonaias gigantea	2	0.040	0.198	2	4.0
Amblema plicata	16	0.320	0.913	8	16.0
Quadrula quadrula	1	0.020	0.141	1	2.0
Quadrula pustulosa	1	0.020	0.141	1	2.0
Quadrula nodulata	1	0.020	0.141	1	2.0
Arcidens confragosus					
Lasmigona complanata					
Anodonta grandis					
Anodonta imbecillis					
Obliquaria reflexa	2	0.040	0.198	2	4.0
Truncilla truncata					
Truncilla donaciformis	4	0.080	0.340	3	6.0
Leptodea fragilis					
Proptera alata					
Proptera laevissima	4	0.080	0.274	4	8.0
Lampsilis teres	1	0.020	0.141	1	2.0
Unidentified					
Total Mussels	32	0.640	1.241	17	34.0
Musculium transversum					
Corbicula fluminea	40	0.800	1.443	17	34.0

Appendix B continued.

Table B4.
Numbers of live mussels and clams taken in 50 $0.5m^2$ samples on transect 9-8 from the fleeted area of the Illinois River at Naples.

	Total	Mean per $0.5\ m^2$	S.D.	No. of samples in which species occurred	Percent occurrence
Fusconaia flava					
Megalonaias gigantea					
Amblema plicata	44	0.880	1.365	22	44.0
Quadrula quadrula	23	0.460	1.014	14	28.0
Quadrula pustulosa	26	0.520	0.995	16	32.0
Quadrula nodulata	11	0.220	0.507	9	18.0
Arcidens confragosus					
Lasmigona complanata	1	0.020	0.141	1	2.0
Anodonta grandis	1	0.020	0.141	1	2.0
Anodonta imbecillis	1	0.020	0.141	1	2.0
Obliquaria reflexa	1	0.020	0.141	1	2.0
Truncilla truncata					
Truncilla donaciformis	70	1.400	1.807	32	64.0
Leptodea fragilis	29	0.580	0.950	18	36.0
Proptera alata					
Proptera laevissima	13	0.260	0.565	10	20.0
Lampsilis teres					
Unidentified	3	0.060	0.240	4	8.0
Total Mussels	223	4.460	4.572	46	92.0
Musculium transversum					
Corbicula fluminea	559	11.180	7.698	50	100.0

Appendix B continued.

Table B5.
Numbers of live mussels and clams Taken in 49 $0.5m^2$ samples on transect 10-9 from the fleeted area of the Illinois River at Naples.

	Total	Mean per $0.5\ m^2$	S.D.	No. of Samples in which species occurred	Percent occur-rence
Fusconaia flava					
Megalonaias gigantea					
Amblema plicata	40	0.816	1.481	22	44.9
Quadrula quadrula	6	0.122	0.331	6	32.8
Quadrula pustulosa	13	0.265	0.531	11	22.4
Quadrula nodulata	1	0.020	0.143	1	2.0
Arcidens confragosus	1	0.020	0.143	1	2.0
Lasmigona complanata					
Anodonta grandis					
Anodonta imbecillis					
Obliquaria reflexa	3	0.061	0.242	3	6.1
Truncilla truncata					
Truncilla donaciformis	111	2.265	3.499	30	61.2
Leptodea fragilis	30	0.612	1.351	15	30.6
Proptera alata	3	0.061	0.242	3	6.1
Proptera laevissima	16	0.327	0.591	13	26.5
Lampsilis teres					
Unidentified	5	0.102	0.306	5	10.2
Total Mussels	229	4.673	4.819	45	91.8
Musculium transversum	5	0.102	0.467	3	6.1
Corbicula fluminea	329	6.714	6.831	45	91.8

Appendix B continued.

Table B6.
Numbers of live mussels and clams taken in 50 $0.5m^2$ samples on transect 8-11 from the fleeted area of the Illinois River at Naples.

	Total	Mean per $0.5\ m^2$	S.D.	No. of Samples in which species occurred	Percent occurrence
Fusconaia flava					
Megalonaias gigantea					
Amblema plicata	92	1.840	2.262	34	64.0
Quadrula quadrula	16	0.320	0.844	9	18.0
Quadrula pustulosa	18	0.360	0.722	12	24.0
Quadrula nodulata	13	0.260	0.600	10	20.0
Arcidens confragosus					
Lasmigona complanata					
Anodonta grandis					
Anodonta imbecillis					
Obliquaria reflexa	2	0.040	0.198	2	4.0
Truncilla truncata	1	0.020	0.141	1	2.0
Truncilla donaciformis	149	2.980	2.104	47	94.0
Leptodea fragilis	28	0.560	0.907	18	36.0
Proptera alata	3	0.060	0.240	3	6.0
Proptera laevissima	6	0.120	0.328	6	12.0
Lampsilis teres					
Unidentified	3	0.060	0.240	3	6.0
Total Mussels	331	6.620	5.030	50	100.0
Musculium transversum	4	0.080	0.274	4	8.0
Corbicula fluminea	589	13.780	13.252	48	96.0

Appendix C. Data for mussels captured and marked in 1984 at the Illinois River study site, Naples, IL.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1	31-May-84	GROUND	GROUND	AP			7.501	11.300	RT VALVE-SLIGHT SCRAPE
2	31-May-84	GROUND	GROUND	AP		DA	9.169	12.400	LF VALVE-SLIGHT SCRAPE
3	31-May-84	GROUND	GROUND	QP			5.771	6.170	
4	31-May-84	GROUND	GROUND	AP	DE				
5	31-May-84	GROUND	GROUND	QP	DE				
6	12-Jun-84	GROUND	GROUND	AP			6.939	9.070	
7	12-Jun-84	GROUND	GROUND	AP			7.480	10.119	
8	12-Jun-84	GROUND	GROUND	AP			8.131	11.270	
9	12-Jun-84	GROUND	GROUND	AP			7.610	10.190	
10	12-Jun-84	GROUND	GROUND	AP			9.241	11.730	
11	12-Jun-84	GROUND	GROUND	AP			7.879	11.140	
12	12-Jun-84	GROUND	GROUND	AP			7.920	10.980	
13	12-Jun-84	GROUND	GROUND	AP			7.531	10.630	
14	12-Jun-84	GROUND	GROUND	AP			7.361	9.561	
15	12-Jun-84	GROUND	GROUND	AP			7.079	9.530	
16	12-Jun-84	GROUND	GROUND	QQ			4.521	5.250	
17	12-Jun-84	GROUND	GROUND	QP			5.850	6.309	
18	12-Jun-84	GROUND	GROUND	QP			4.900	5.791	
19	12-Jun-84	GROUND	GROUND	AP			5.301	6.629	
20	12-Jun-84	GROUND	GROUND	OR			3.391	4.140	
21	12-Jun-84	GROUND	GROUND	LF			6.139	8.590	
22	12-Jun-84	GROUND	GROUND	QP			5.860	6.350	
23	12-Jun-84	GROUND	GROUND	QP			5.941	6.629	
24	12-Jun-84	GROUND	GROUND	QQ	DE				VALVES SEPARATED
25	12-Jun-84	GROUND	GROUND	MG	DE				
26	12-Jun-84	GROUND	GROUND	AP	DE				
27	05-Jun-84	PILING	PILING	LF			6.464	10.140	
28	05-Jun-84	PILING	PILING	PL			6.957	9.731	
29	05-Jun-84	PILING	PILING	LF			6.314	10.859	
30	05-Jun-84	PILING	PILING	LF			6.548	10.444	
31	05-Jun-84	PILING	PILING	LF			5.944	8.821	
32	05-Jun-84	PILING	PILING	PL			7.061	9.012	
33	05-Jun-84	PILING	PILING	QN			4.867	5.413	
34	05-Jun-84	PILING	PILING	LF			6.038	9.622	
35	05-Jun-84	PILING	PILING	LF			5.652	6.020	
36	05-Jun-84	PILING	PILING	LF			4.389	7.226	
37	05-Jun-84	PILING	PILING	LF			4.509	6.972	
38	05-Jun-84	PILING	PILING	PL		DA	6.378	8.506	RT VALVE-SCRAPED AND HOLE THROUGH
39	05-Jun-84	PILING	PILING	PL			6.170	8.674	
40	05-Jun-84	PILING	PILING	PL			5.839	7.684	
41	05-Jun-84	PILING	PILING	PL			6.292	8.247	
42	05-Jun-84	PILING	PILING	LF			5.974	8.189	
43	05-Jun-84	PILING	PILING	LF			5.364	7.828	
44	05-Jun-84	PILING	PILING	LF			4.834	7.303	
45	05-Jun-84	PILING	PILING	LF			4.470	6.469	
46	05-Jun-84	PILING	PILING	PL			6.322	8.334	
47	05-Jun-84	PILING	PILING	PL		DA	5.560	7.280	POST RT VALVE-BROKEN

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
48	05-Jun-84	PILING	PILING	PL			5.436	6.838	ENGRAVED HOLE
49	05-Jun-84	PILING	PILING	PL			4.641	6.599	
50	05-Jun-84	PILING	PILING	OR			3.866	4.661	
51	05-Jun-84	PILING	PILING	PA			9.106	11.527	
52	05-Jun-84	PILING	PILING	PL			6.609	7.960	
53	05-Jun-84	PILING	PILING	PL			6.469	8.989	
54	05-Jun-84	PILING	PILING	PL			5.872	8.214	
55	05-Jun-84	PILING	PILING	LT			7.300	14.869	
56	05-Jun-84	PILING	PILING	LF			7.082	10.653	
57	05-Jun-84	PILING	PILING	LF			5.570	8.750	
58	05-Jun-84	PILING	PILING	LF			5.636	8.715	
59	05-Jun-84	PILING	PILING	LF			5.146	7.828	
60	05-Jun-84	PILING	PILING	LF			5.248	8.659	
61	05-Jun-84	PILING	PILING	AG	DE		8.661	12.972	
62	05-Jun-84	PILING	PILING	LF			5.939	9.101	
63	12-Jun-84	GROUND	GROUND	QQ			7.706	8.486	
64	12-Jun-84	GROUND	GROUND	LF		DA	5.573	8.296	
65	12-Jun-84	GROUND	GROUND	AP			7.861	11.199	
66	12-Jun-84	GROUND	GROUND	AP			7.892	10.665	
67	12-Jun-84	GROUND	GROUND	AP			7.419	10.117	
68	12-Jun-84	GROUND	GROUND	AP			7.209	9.779	
69	12-Jun-84	GROUND	GROUND	AP			6.657	9.185	
70	12-Jun-84	GROUND	GROUND	AP			7.102	9.799	
71	12-Jun-84	GROUND	GROUND	AP		DA	7.653	10.531	RT VALVE-HOLE THROUGH,DEEP SCRAPES
72	12-Jun-84	GROUND	GROUND	AP			6.292	8.951	
73	12-Jun-84	GROUND	GROUND	AP			8.209	10.861	
74	12-Jun-84	GROUND	GROUND	AP	DE		6.817	9.304	
75	12-Jun-84	GROUND	GROUND	AP	DE				
76	12-Jun-84	GROUND	GROUND	AP			7.082	9.451	
77	12-Jun-84	GROUND	GROUND	MG			11.491	17.384	
78	12-Jun-84	GROUND	GROUND	QQ			6.274	7.485	
79	12-Jun-84	GROUND	GROUND	QQ			4.506	4.856	
80	12-Jun-84	GROUND	GROUND	QP			5.890	6.378	
81	12-Jun-84	GROUND	GROUND	AP			3.988	4.948	
82	12-Jun-84	GROUND	GROUND	MG			12.101	17.361	
83	12-Jun-84	GROUND	GROUND	AP			7.871	10.384	
84	12-Jun-84	GROUND	GROUND	AP			7.262	9.970	
85	12-Jun-84	GROUND	GROUND	AP			7.173	10.475	
86	12-Jun-84	GROUND	GROUND	AP			6.952	9.804	
87	12-Jun-84	GROUND	GROUND	AP			5.690	7.120	
88	12-Jun-84	GROUND	GROUND	AP	DE				
89	12-Jun-84	GROUND	GROUND	AP			7.574	9.797	
90	12-Jun-84	GROUND	GROUND	QQ			6.607	8.006	
91	12-Jun-84	GROUND	GROUND	QQ			6.287	7.455	
92	12-Jun-84	GROUND	GROUND	PA		DA	7.267	11.453	WING ABOVE HINGE-BROKEN
93	12-Jun-84	GROUND	GROUND	MG			11.113	16.289	
94	12-Jun-84	GROUND	GROUND	AP			7.551	10.150	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
95	12-Jun-84	GROUND	GROUND	AP		7.526	10.363	
96	12-Jun-84	GROUND	GROUND	AP		8.014	11.059	BOTH VALVES-SLIGHT EROSION
97	12-Jun-84	GROUND	GROUND	AP		8.458	11.816	
98	12-Jun-84	GROUND	GROUND	AP	DE			
99	12-Jun-84	GROUND	GROUND	QQ		6.279	7.668	
100	12-Jun-84	GROUND	GROUND	AP		4.206	5.309	
101	12-Jun-84	GROUND	GROUND	QP		5.862	6.030	
102	12-Jun-84	GROUND	GROUND	QP		6.066	6.640	
103	12-Jun-84	GROUND	GROUND	QQ		5.471	6.690	
104	12-Jun-84	GROUND	GROUND	QQ		4.056	4.491	
105	12-Jun-84	GROUND	GROUND	OR		4.455	5.405	
106	12-Jun-84	GROUND	GROUND	AP		8.006	10.770	
107	12-Jun-84	GROUND	GROUND	AP		6.878	9.596	
108	12-Jun-84	GROUND	GROUND	AP		8.451	11.288	
109	12-Jun-84	GROUND	GROUND	AP		7.412	10.234	
110	12-Jun-84	GROUND	GROUND	AP		8.039	11.097	
111	12-Jun-84	GROUND	PILING	AP		8.466	10.996	
112	12-Jun-84	GROUND	PILING	AP		7.531	10.427	
113	12-Jun-84	GROUND	PILING	AP		7.061	10.005	
114	12-Jun-84	GROUND	PILING	AP		6.848	9.411	
115	12-Jun-84	GROUND	PILING	AP		7.145	9.599	
116	12-Jun-84	GROUND	PILING	AP		7.254	10.074	BOTH VALVES-SOME EROSION
117	12-Jun-84	GROUND	PILING	AP		6.845	9.284	RT VALVE-SCRAPE HINGE-DAM
118	12-Jun-84	GROUND	PILING	AP		6.124	7.732	
119	12-Jun-84	GROUND	PILING	AP		7.813	10.622	
120	12-Jun-84	GROUND	PILING	AP		7.010	9.238	
121	12-Jun-84	GROUND	PILING	AP		5.547	7.315	
122	12-Jun-84	GROUND	PILING	AP		3.835	4.953	
123	12-Jun-84	GROUND	PILING	AP		7.033	8.948	
124	12-Jun-84	GROUND	PILING	QP		5.771	6.363	
125	12-Jun-84	GROUND	PILING	QP		5.464	6.170	
126	12-Jun-84	GROUND	PILING	AP		7.889	10.645	
127	12-Jun-84	GROUND	PILING	AP		7.597	10.511	
128	12-Jun-84	GROUND	PILING	AP		7.983	10.561	
129	12-Jun-84	GROUND	PILING	AP		7.648	10.282	
130	12-Jun-84	GROUND	PILING	AP	DE			
131	12-Jun-84	GROUND	PILING	AP		5.550	7.186	
132	12-Jun-84	GROUND	PILING	AP		7.460	10.224	RT VALVE-2 RIDGES SCRAPED
133	12-Jun-84	GROUND	PILING	AP		6.960	9.167	
134	12-Jun-84	GROUND	PILING	AP		8.141	10.627	
135	12-Jun-84	GROUND	PILING	MG		12.014	17.386	
136	12-Jun-84	GROUND	PILING	AP		7.094	9.967	
137	12-Jun-84	GROUND	PILING	QP		4.890	5.352	
138	12-Jun-84	GROUND	PILING	QQ		5.271	6.236	
139	12-Jun-84	GROUND	PILING	QQ		4.110	4.895	
140	12-Jun-84	GROUND	PILING	AP		7.216	10.485	
141	12-Jun-84	GROUND	PILING	AP		7.473	9.878	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
142	12-Jun-84	GROUND	PILING	AP			8.105	10.627	
143	12-Jun-84	GROUND	PILING	AP			6.535	9.131	
144	12-Jun-84	GROUND	PILING	AP			6.817	9.746	
145	12-Jun-84	GROUND	PILING	AP			5.169	6.388	
146	12-Jun-84	GROUND	PILING	AP			7.480	10.617	
147	12-Jun-84	GROUND	PILING	AP			7.661	10.508	
148	12-Jun-84	GROUND	PILING	QQ			6.109	7.394	
149	12-Jun-84	GROUND	PILING	QQ			5.799	6.876	
150	12-Jun-84	GROUND	PILING	QQ			3.581	4.450	
151	12-Jun-84	GROUND	PILING	QP			5.217	5.715	
152	12-Jun-84	GROUND	PILING	QP			5.794	6.612	BEAKS ERODED
153	12-Jun-84	GROUND	PILING	AP	DE				
154	12-Jun-84	GROUND	PILING	QP			5.116	5.872	
155	12-Jun-84	GROUND	PILING	QP			4.846	5.591	
156	12-Jun-84	GROUND	PILING	QP			3.965	4.338	
157	12-Jun-84	GROUND	PILING	QP			5.634	5.867	
158	12-Jun-84	GROUND	PILING	QP			5.591	5.735	
159	12-Jun-84	GROUND	PILING	QQ			6.264	7.369	
160	12-Jun-84	GROUND	PILING	OR			3.340	4.392	
161	12-Jun-84	GROUND	PILING	AP			7.884	11.021	
162	12-Jun-84	GROUND	PILING	AP			5.817	7.475	
163	12-Jun-84	GROUND	PILING	AP			8.273	11.290	
164	12-Jun-84	GROUND	PILING	AP			7.691	10.795	
165	12-Jun-84	GROUND	PILING	AP			8.240	11.311	
166	12-Jun-84	GROUND	PILING	AP			7.531	10.229	
167	12-Jun-84	GROUND	PILING	AP			7.226	9.906	
168	12-Jun-84	GROUND	PILING	AP			7.927	11.364	
169	12-Jun-84	GROUND	PILING	AP			8.131	10.556	
170	12-Jun-84	GROUND	PILING	AP			7.595	9.939	
171	12-Jun-84	GROUND	PILING	AP			7.615	9.964	
172	12-Jun-84	GROUND	PILING	AP			8.468	10.932	
173	12-Jun-84	GROUND	PILING	AP			8.656	11.608	
174	12-Jun-84	GROUND	PILING	AP			6.668	9.723	
175	12-Jun-84	GROUND	PILING	AP			7.153	9.599	HINGE LIG-BROKEN
176	12-Jun-84	GROUND	PILING	AP			8.148	11.506	
177	12-Jun-84	GROUND	PILING	AP			7.280	9.451	
178	12-Jun-84	GROUND	PILING	AP			7.493	9.947	
179	12-Jun-84	GROUND	PILING	QP			5.735	6.015	
180	12-Jun-84	GROUND	PILING	AG		DA	7.087	10.744	RT VALVE-HOLE POKED THROUGH
181	13-Jun-84	DWNSTRM	DWNSTRM	AP			6.482	8.976	
182	13-Jun-84	DWNSTRM	DWNSTRM	AP			6.734	9.164	
183	13-Jun-84	DWNSTRM	DWNSTRM	AP			6.414	8.595	
184	13-Jun-84	DWNSTRM	DWNSTRM	AP			6.728	8.694	
185	13-Jun-84	DWNSTRM	DWNSTRM	AP	DE				
186	13-Jun-84	DWNSTRM	DWNSTRM	AP			6.462	8.245	
187	13-Jun-84	DWNSTRM	DWNSTRM	AP			7.137	9.144	
188	13-Jun-84	DWNSTRM	DWNSTRM	AP			4.958	6.502	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
189	13-Jun-84	DWNSTRM	DWNSTRM	AP			5.392	7.049	
190	14-Jun-84	DWNSTRM	DWNSTRM	PA			10.117	13.927	
191	14-Jun-84	DWNSTRM	DWNSTRM	LF			2.616	4.521	
192	14-Jun-84	DWNSTRM	DWNSTRM	PL	DE				
193	14-Jun-84	DWNSTRM	DWNSTRM	LF		DA	7.696	12.316	HINGE-BROKEN VALVES-ERODED,DEFORMED
194	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.855	7.826	
194.5	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.602	10.511	
195	14-Jun-84	DWNSTRM	DWNSTRM	AP			8.382	12.009	
196	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.529	10.262	
197	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.249	9.881	
198	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.188	8.788	
199	14-Jun-84	DWNSTRM	DWNSTRM	AP			6.548	9.035	
200	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.552	7.361	
201	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.112	9.815	RT VALVE-SLIGHT EROSION
202	14-Jun-84	DWNSTRM	DWNSTRM	QP			5.593	5.751	
203	14-Jun-84	DWNSTRM	DWNSTRM	QP			5.842	6.345	
204	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.305	9.754	
205	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.812	7.516	
206	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.855	7.907	LF VALVE-SLIGHT EROSION
207	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.071	10.076	
208	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.765	10.587	
209	14-Jun-84	DWNSTRM	DWNSTRM	AP			6.858	8.984	
210	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.363	9.370	
211	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.701	10.310	BEAK-EROSION
212	14-Jun-84	DWNSTRM	DWNSTRM	QQ			5.662	6.386	
213	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.849	10.922	BEAK-SLIGHT EROSION
214	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.214	10.160	BEAK-SLIGHT EROSION
215	14-Jun-84	DWNSTRM	DWNSTRM	AP			6.995	9.609	
216	14-Jun-84	DWNSTRM	DWNSTRM	AP			6.784	9.454	
217	14-Jun-84	DWNSTRM	DWNSTRM	AP			8.339	10.838	
218	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.423	7.292	
219	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.882	10.724	
220	14-Jun-84	DWNSTRM	DWNSTRM	AP			8.232	11.651	RT VALVE-SLIGHT EROSION
221	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.271	6.848	
222	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.772	10.734	LF VALVE-SLIGHT EROSION
223	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.757	9.964	BOTH VALVES-SL EROS,DEFORMED MARGINS
224	14-Jun-84	DWNSTRM	DWNSTRM	AP			8.730	11.240	BEAK AND VALVES-SLIGHT EROSION
225	14-Jun-84	DWNSTRM	DWNSTRM	QN			3.848	4.171	
226	14-Jun-84	DWNSTRM	DWNSTRM	QP			4.663	4.930	
227	14-Jun-84	DWNSTRM	DWNSTRM	AP			6.965	6.805	MEASUREMENTS SUSPECT
228	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.359	7.305	
229	14-Jun-84	DWNSTRM	DWNSTRM	AP			9.512	11.908	BOTH VALVES-EROSION
230	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.404	9.865	
231	14-Jun-84	DWNSTRM	DWNSTRM	AP			6.299	8.395	
232	14-Jun-84	DWNSTRM	DWNSTRM	AP			5.288	7.015	
233	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.709	10.871	
234	14-Jun-84	DWNSTRM	DWNSTRM	AP			7.762	11.168	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
235	14-Jun-84	DWNSTRM	DWNSTRM	AP		7.209	9.190	
236	14-Jun-84	DWNSTRM	DWNSTRM	AP		7.109	8.908	
237	14-Jun-84	DWNSTRM	DWNSTRM	AP		7.099	10.036	LF VALVE-SLIGHT EROSION
238	18-Jun-84	PILING	GROUND	LF		5.194	8.796	
239	18-Jun-84	PILING	GROUND	LF		6.604	9.614	
240	18-Jun-84	PILING	GROUND	LF		5.794	9.149	
241	18-Jun-84	PILING	GROUND	LF		4.702	7.435	
242	18-Jun-84	PILING	GROUND	LF		4.150	7.356	
243	18-Jun-84	PILING	GROUND	LF		5.212	8.781	
244	18-Jun-84	PILING	GROUND	LF		7.188	11.669	
245	18-Jun-84	PILING	GROUND	LF		3.940	6.774	
246	18-Jun-84	PILING	GROUND	LF		5.403	8.783	
247	18-Jun-84	PILING	GROUND	LF		5.664	8.539	
248	18-Jun-84	PILING	GROUND	LF		5.794	9.370	
249	18-Jun-84	PILING	GROUND	LF		6.977	11.516	
250	18-Jun-84	PILING	GROUND	LF		4.069	6.769	
251	18-Jun-84	PILING	GROUND	LF		5.306	8.565	
252	18-Jun-84	PILING	GROUND	LF		4.966	8.268	
253	18-Jun-84	PILING	GROUND	LF		5.400	8.936	
254	18-Jun-84	PILING	GROUND	LF		4.564	7.795	
255	18-Jun-84	PILING	GROUND	LF		6.147	10.325	
256	18-Jun-84	PILING	GROUND	LF		5.398	8.910	
257	18-Jun-84	PILING	GROUND	LF		4.905	8.019	
258	18-Jun-84	PILING	GROUND	LF		5.502	9.065	
259	18-Jun-84	PILING	GROUND	LF		4.704	7.381	
260	18-Jun-84	PILING	GROUND	LF		4.427	7.440	
261	18-Jun-84	PILING	GROUND	PA		5.387	7.135	
262	18-Jun-84	PILING	GROUND	PA		5.316	7.051	
263	18-Jun-84	PILING	GROUND	LF		5.334	7.386	
264	18-Jun-84	PILING	GROUND	LF		4.661	7.066	
265	18-Jun-84	PILING	GROUND	LF		6.279	9.848	
266	18-Jun-84	PILING	GROUND	LF		3.188	5.273	
267	18-Jun-84	PILING	GROUND	LF		3.363	5.608	
268	18-Jun-84	PILING	GROUND	LF		5.585	8.870	
269	18-Jun-84	PILING	GROUND	LF		5.654	8.755	
270	18-Jun-84	PILING	GROUND	LF		4.509	7.422	
271	18-Jun-84	PILING	GROUND	LF		5.240	8.153	
272	18-Jun-84	PILING	GROUND	LF		2.344	3.924	
273	18-Jun-84	PILING	GROUND	LF		3.658	5.786	
274	18-Jun-84	PILING	GROUND	LF		6.223	9.045	
275	18-Jun-84	PILING	GROUND	LF		3.459	5.959	
276	18-Jun-84	PILING	GROUND	LF		4.475	6.622	
277	18-Jun-84	PILING	GROUND	AG		7.953	13.973	
278	18-Jun-84	PILING	GROUND	LF		4.232	6.584	
279	18-Jun-84	PILING	GROUND	LF		6.886	9.594	
280	18-Jun-84	PILING	GROUND	LF			5.525	
281	18-Jun-84	PILING	GROUND	LF			6.231	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
282	18-Jun-84	PILING	GROUND	LF			5.154	
283	18-Jun-84	PILING	GROUND	LF		5.039	8.611	
284	18-Jun-84	PILING	GROUND	AG		5.766	12.830	
285	18-Jun-84	PILING	GROUND	LF		3.975	6.038	
286	18-Jun-84	PILING	GROUND	PL		6.261	8.885	
287	18-Jun-84	PILING	GROUND	LT		4.694	10.605	
288	18-Jun-84	PILING	GROUND	LF		3.239	5.707	
289	18-Jun-84	PILING	GROUND	PL		6.457	9.106	
290	18-Jun-84	PILING	GROUND	PL		7.938	10.185	
291	18-Jun-84	PILING	GROUND	PA		6.335	7.513	
292	18-Jun-84	GROUND	GROUND	AP		8.364	11.107	
293	18-Jun-84	GROUND	GROUND	AP		7.645	9.820	
294	18-Jun-84	GROUND	GROUND	AP		4.813	6.246	
295	18-Jun-84	GROUND	GROUND	AP		3.419	4.308	
296	18-Jun-84	GROUND	GROUND	QQ		5.192	6.248	
297	18-Jun-84	GROUND	GROUND	QQ		4.856	5.878	
298	18-Jun-84	GROUND	GROUND	QP		5.707	6.002	
299	18-Jun-84	GROUND	GROUND	QP		5.309	6.002	
300	18-Jun-84	GROUND	GROUND	QQ		4.491	5.136	
301	18-Jun-84	GROUND	GROUND	QQ		2.852	3.569	
302	18-Jun-84	GROUND	GROUND	QN		3.795	4.430	
303	18-Jun-84	GROUND	GROUND	QN		3.416	3.754	
304	18-Jun-84	GROUND	GROUND	LF		3.167	5.235	
305	18-Jun-84	GROUND	GROUND	LF		3.592	8.181	
306	18-Jun-84	GROUND	GROUND	LF		3.010	5.032	
307	18-Jun-84	GROUND	GROUND	LF		3.581	5.723	
308	18-Jun-84	GROUND	GROUND	LF		3.106	5.372	
309	18-Jun-84	GROUND	GROUND	LF		3.820	6.375	
310	18-Jun-84	GROUND	GROUND	LF		3.302	5.575	
311	18-Jun-84	GROUND	GROUND	AP	DA	6.728	8.941	LFT VALVE-SCRAPED
312	18-Jun-84	GROUND	GROUND	PL		6.350	7.775	
313	18-Jun-84	GROUND	GROUND	PL	DA	7.620	9.144	LFT VALVE POST-BROKEN
314	18-Jun-84	GROUND	GROUND	PL	DA	5.949	8.407	LFT VALVE POST-CHIPPED
315	18-Jun-84	GROUND	GROUND	PL		5.469	6.982	
316	18-Jun-84	GROUND	GROUND	PL		3.950	5.563	
317	18-Jun-84	GROUND	GROUND	AP		7.874	10.749	
318	18-Jun-84	GROUND	GROUND	AP		7.836	10.160	
319	18-Jun-84	GROUND	GROUND	AP		7.417	10.132	
320	18-Jun-84	GROUND	GROUND	AP		8.222	10.897	
321	18-Jun-84	GROUND	GROUND	AP		7.031	9.703	
322	18-Jun-84	GROUND	GROUND	AP		5.677	7.498	
323	18-Jun-84	GROUND	GROUND	AP		8.382	11.252	
324	18-Jun-84	GROUND	GROUND	AP		7.135	9.731	
325	18-Jun-84	GROUND	GROUND	AP		7.198	9.553	
326	18-Jun-84	GROUND	GROUND	AP		4.460	5.715	
327	18-Jun-84	GROUND	GROUND	AP		8.123	11.311	
328	18-Jun-84	GROUND	GROUND	AP		4.605	6.182	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
329	18-Jun-84	GROUND	GROUND	AP		7.925	11.156	
330	18-Jun-84	GROUND	GROUND	AP		7.988	10.947	
331	18-Jun-84	GROUND	GROUND	AP		5.812	7.615	
332	18-Jun-84	GROUND	GROUND	AP		4.150	5.372	
333	18-Jun-84	GROUND	GROUND	AP		4.206	5.339	
334	18-Jun-84	GROUND	GROUND	QQ		6.441	7.935	
335	18-Jun-84	GROUND	GROUND	QQ		4.196	4.882	
336	18-Jun-84	GROUND	GROUND	QQ		5.443	6.297	
337	18-Jun-84	GROUND	GROUND	QP		5.791	6.640	
338	18-Jun-84	GROUND	GROUND	QP		5.207	5.540	
339	18-Jun-84	GROUND	GROUND	QP		5.347	6.126	
340	18-Jun-84	GROUND	GROUND	QP		4.816	4.928	
341	18-Jun-84	GROUND	GROUND	QP		4.816	5.443	
342	19-Jun-84	PILING	DWNSTRM	LF		6.678	9.751	
343	19-Jun-84	PILING	DWNSTRM	LF		7.176	10.513	
344	19-Jun-84	PILING	DWNSTRM	LF		5.321	8.070	
345	19-Jun-84	PILING	DWNSTRM	LF		4.110	6.563	
346	19-Jun-84	PILING	DWNSTRM	LF		7.224	10.808	
347	19-Jun-84	PILING	DWNSTRM	LF		3.132	5.151	
348	19-Jun-84	PILING	DWNSTRM	LF		3.805	6.556	
349	19-Jun-84	PILING	DWNSTRM	LF		4.681	7.104	
350	19-Jun-84	PILING	DWNSTRM	LF		4.577	6.845	
351	19-Jun-84	PILING	DWNSTRM	LF		4.770	6.782	
352	19-Jun-84	PILING	DWNSTRM	LF		4.526	6.835	
353	19-Jun-84	PILING	DWNSTRM	LF		4.389	6.726	
354	19-Jun-84	PILING	DWNSTRM	LF		7.557	11.021	
355	19-Jun-84	PILING	DWNSTRM	LF		6.530	9.375	
356	19-Jun-84	PILING	DWNSTRM	LF		6.883	9.680	
357	19-Jun-84	PILING	DWNSTRM	LF		5.507	7.529	
358	19-Jun-84	PILING	DWNSTRM	LF		3.518	5.682	
359	19-Jun-84	PILING	DWNSTRM	LF	DA	5.103	7.239	RT BEAK-PUNCTURED
360	19-Jun-84	PILING	DWNSTRM	LF		4.364	6.533	
361	19-Jun-84	PILING	DWNSTRM	LF		4.577	7.592	
362	19-Jun-84	PILING	DWNSTRM	LF	DA	7.158	10.775	POST VALVES-CHIPPED
363	19-Jun-84	PILING	DWNSTRM	LF		6.096	8.666	
364	19-Jun-84	PILING	DWNSTRM	LF		5.428	8.087	
365	19-Jun-84	PILING	DWNSTRM	LF		3.482	5.695	
366	19-Jun-84	PILING	DWNSTRM	LF		3.526	5.999	
367	19-Jun-84	PILING	DWNSTRM	LF		4.371	6.408	
368	19-Jun-84	PILING	DWNSTRM	LF		3.368	5.949	
369	19-Jun-84	PILING	DWNSTRM	LF		4.851	7.800	
370	19-Jun-84	PILING	DWNSTRM	LF		6.177	9.141	
371	19-Jun-84	PILING	DWNSTRM	LF		5.565	7.945	
372	19-Jun-84	PILING	DWNSTRM	LF		3.985	6.345	
373	19-Jun-84	PILING	DWNSTRM	LF		3.800	6.271	
374	19-Jun-84	PILING	DWNSTRM	LF		7.259	8.420	
375	19-Jun-84	PILING	DWNSTRM	LF		6.586	9.350	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
376	19-Jun-84	PILING	DWNSTRM	LF		6.535	9.728	
377	19-Jun-84	PILING	DWNSTRM	LF		5.192	8.397	
378	19-Jun-84	PILING	DWNSTRM	LF		6.231	8.920	
379	19-Jun-84	PILING	DWNSTRM	LF		4.674	6.716	
380	19-Jun-84	PILING	DWNSTRM	LF		3.320	5.674	
381	19-Jun-84	PILING	DWNSTRM	LF		4.044	5.870	
382	19-Jun-84	PILING	DWNSTRM	LF		4.158	6.518	
383	19-Jun-84	PILING	DWNSTRM	LF		3.604	5.890	
384	19-Jun-84	PILING	DWNSTRM	LF		3.658	5.728	
385	19-Jun-84	PILING	DWNSTRM	LF		3.388	5.913	
386	19-Jun-84	PILING	DWNSTRM	LF		3.155	5.413	
387	19-Jun-84	PILING	DWNSTRM	LF		3.653	5.629	
388	19-Jun-84	PILING	DWNSTRM	LF		4.394	6.528	
389	19-Jun-84	PILING	DWNSTRM	LF		4.328	6.586	
390	19-Jun-84	PILING	DWNSTRM	PL		7.094	9.020	
391	19-Jun-84	PILING	DWNSTRM	PL		6.622	9.047	
392	19-Jun-84	PILING	DWNSTRM	PL		7.480	9.843	
393	19-Jun-84	PILING	DWNSTRM	PL		6.731	9.070	
394	19-Jun-84	PILING	DWNSTRM	PL		6.698	8.346	
395	19-Jun-84	PILING	DWNSTRM	PL		6.596	9.111	
396	19-Jun-84	PILING	DWNSTRM	PL		6.175	7.831	
397	19-Jun-84	PILING	DWNSTRM	PL		6.048	7.661	
398	19-Jun-84	PILING	DWNSTRM	PL		5.532	7.303	
399	19-Jun-84	PILING	DWNSTRM	PL		6.294	7.333	
400	19-Jun-84	PILING	DWNSTRM	PL		4.940	6.848	
401	19-Jun-84	PILING	DWNSTRM	AG		6.116	9.952	
402	19-Jun-84	PILING	DWNSTRM	AG		7.008	10.366	
403	19-Jun-84	PILING	DWNSTRM	LT		4.138	9.441	
404	19-Jun-84	PILING	DWNSTRM	LT		4.702	10.759	
405	19-Jun-84	PILING	DWNSTRM	LT		4.145	8.143	
406	19-Jun-84	PILING	DWNSTRM	PL		5.573	7.584	
407	18-Jun-84	PILING	DWNSTRM	PL		5.527	7.201	
408	19-Jun-84	PILING	DWNSTRM	PL		4.267	6.675	
409	19-Jun-84	PILING	DWNSTRM	PL		5.019	7.209	
410	19-Jun-84	PILING	DWNSTRM	PL		4.483	6.116	
411	19-Jun-84	PILING	DWNSTRM	PL		4.481	6.266	
412	19-Jun-84	UPSTRM	UPSTRM	LF		5.055	7.709	
413	19-Jun-84	UPSTRM	UPSTRM	AP		7.734	10.772	
414	19-Jun-84	UPSTRM	UPSTRM	AP		6.591	8.776	
415	19-Jun-84	UPSTRM	UPSTRM	AP		6.467	7.879	
416	19-Jun-84	UPSTRM	UPSTRM	AP		6.048	7.861	
417	19-Jun-84	UPSTRM	UPSTRM	AP		3.734	5.055	
418	19-Jun-84	UPSTRM	UPSTRM	AG		6.845	10.724	
419	19-Jun-84	UPSTRM	UPSTRM	AG		8.666	14.183	
420	19-Jun-84	UPSTRM	UPSTRM	AG		7.991	12.705	
421	19-Jun-84	UPSTRM	UPSTRM	AP	DE			
422	19-Jun-84	UPSTRM	UPSTRM	AG		8.725	14.003	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
423	19-Jun-84	UPSTRM	UPSTRM	AG			8.087	12.918	
424	19-Jun-84	UPSTRM	UPSTRM	PL			7.282	9.200	
425	19-Jun-84	UPSTRM	UPSTRM	PL			7.351	9.787	
426	19-Jun-84	UPSTRM	UPSTRM	PL			7.056	9.482	
427	19-Jun-84	UPSTRM	UPSTRM	PL			7.506	9.428	
428	19-Jun-84	UPSTRM	UPSTRM	AP			6.337	7.798	
429	19-Jun-84	UPSTRM	UPSTRM	AP			6.403	8.186	
430	19-Jun-84	UPSTRM	UPSTRM	AP			6.350	7.993	
431	19-Jun-84	UPSTRM	UPSTRM	AP			6.116	7.808	
432	19-Jun-84	UPSTRM	UPSTRM	AP			6.030	7.615	
433	19-Jun-84	UPSTRM	UPSTRM	AP			6.337	7.648	
434	19-Jun-84	UPSTRM	UPSTRM	AP			6.045	7.559	
435	19-Jun-84	UPSTRM	UPSTRM	AP			6.134	8.052	
436	19-Jun-84	UPSTRM	UPSTRM	AP			6.172	7.828	
437	19-Jun-84	UPSTRM	UPSTRM	AP			6.101	7.838	
438	19-Jun-84	UPSTRM	UPSTRM	AP			6.121	7.112	
439	19-Jun-84	UPSTRM	UPSTRM	AP			6.421	7.701	
440	19-Jun-84	UPSTRM	UPSTRM	AP			5.911	7.460	
441	19-Jun-84	UPSTRM	UPSTRM	AP			5.994	7.661	
442	19-Jun-84	UPSTRM	UPSTRM	AP			5.796	7.046	
443	19-Jun-84	UPSTRM	UPSTRM	AP			6.424	8.072	
444	19-Jun-84	UPSTRM	UPSTRM	AP			6.099	7.798	
445	19-Jun-84	UPSTRM	UPSTRM	AP			5.519	6.665	
446	19-Jun-84	UPSTRM	UPSTRM	AP			5.654	7.297	
447	19-Jun-84	UPSTRM	UPSTRM	AP			3.012	3.810	
448	19-Jun-84	UPSTRM	UPSTRM	AP			2.913	3.541	
449	19-Jun-84	UPSTRM	UPSTRM	AP			5.662	6.868	
450	19-Jun-84	UPSTRM	UPSTRM	AG			7.424	12.151	
451	19-Jun-84	UPSTRM	UPSTRM	AG			8.514	14.729	
452	19-Jun-84	UPSTRM	UPSTRM	AG			6.810	9.731	
453	19-Jun-84	UPSTRM	UPSTRM	AP			5.817	7.643	
454	20-Jun-84	GROUND	GROUND	AP			7.633	10.488	LF VALVE-SLIGHT EROSION
455	20-Jun-84	GROUND	GROUND	AP			8.293	11.775	RT VALVE-SLIGHT EROSION
456	20-Jun-84	GROUND	GROUND	AP			7.971	11.196	
457	20-Jun-84	GROUND	GROUND	AP			5.298	7.066	
458	20-Jun-84	GROUND	GROUND	QQ			6.723	8.245	
459	20-Jun-84	GROUND	GROUND	QQ			6.688	8.166	
460	20-Jun-84	GROUND	GROUND	AP			6.911	9.248	
461	20-Jun-84	GROUND	GROUND	AP			5.382	7.226	
462	20-Jun-84	GROUND	GROUND	AP			7.562	10.236	
463	20-Jun-84	GROUND	GROUND	AP			5.265	7.092	
464	20-Jun-84	GROUND	GROUND	AP			5.288	6.944	
465	20-Jun-84	GROUND	GROUND	AP		DA	7.330	10.234	
466	20-Jun-84	GROUND	GROUND	AP			7.450	10.538	
467	20-Jun-84	GROUND	GROUND	AP			7.836	10.559	
468	20-Jun-84	GROUND	GROUND	AP	DE				
469	20-Jun-84	GROUND	GROUND	AP			8.029	10.808	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
470	20-Jun-84	GROUND	GROUND	AP		8.235	10.820	
471	20-Jun-84	GROUND	GROUND	AP		7.722	10.325	
472	20-Jun-84	GROUND	GROUND	AP		7.915	11.166	
473	20-Jun-84	GROUND	GROUND	AP		7.224	10.599	
474	20-Jun-84	GROUND	GROUND	AP		5.745	7.554	
475	20-Jun-84	GROUND	GROUND	AP		8.712	11.610	
476	20-Jun-84	GROUND	GROUND	AP		7.216	9.782	
477	20-Jun-84	GROUND	GROUND	AP		7.811	11.003	
478	20-Jun-84	GROUND	GROUND	AP		7.219	9.916	
479	20-Jun-84	GROUND	GROUND	AP		6.815	9.733	
480	20-Jun-84	GROUND	GROUND	AP		7.455	9.365	
481	20-Jun-84	GROUND	GROUND	AP		8.372	10.965	
482	20-Jun-84	GROUND	GROUND	AP		5.276	6.815	
483	20-Jun-84	GROUND	GROUND	AP	DA	6.429	8.931	LF VALVE-HOLE
484	20-Jun-84	GROUND	GROUND	LF		7.059	11.727	
485	20-Jun-84	GROUND	GROUND	LF		6.693	9.563	
486	20-Jun-84	GROUND	GROUND	QQ		5.720	6.713	
487	20-Jun-84	GROUND	GROUND	QP		6.396	7.026	
488	20-Jun-84	GROUND	GROUND	QP		5.243	5.773	
489	20-Jun-84	GROUND	GROUND	QP		5.128	5.781	
490	20-Jun-84	GROUND	GROUND	QP	DA	6.086	6.566	HINGE-HOLE
491	20-Jun-84	GROUND	GROUND	QQ		5.156	6.256	
492	20-Jun-84	GROUND	GROUND	AP		8.628	10.932	
493	20-Jun-84	GROUND	GROUND	AP		7.973	11.339	
494	20-Jun-84	GROUND	GROUND	AP		8.832	11.935	
495	20-Jun-84	GROUND	GROUND	AP		7.447	10.444	
496	20-Jun-84	GROUND	GROUND	AP		8.021	10.815	
497	20-Jun-84	GROUND	GROUND	LF		7.308	10.737	
498	20-Jun-84	GROUND	GROUND	AP		8.588	11.455	
499	20-Jun-84	GROUND	GROUND	AP		7.607	10.566	
500	20-Jun-84	GROUND	GROUND	PL		7.120	9.185	
501	20-Jun-84	GROUND	GROUND	LF		6.160	9.157	
502	20-Jun-84	GROUND	GROUND	QQ		6.299	7.582	
503	20-Jun-84	GROUND	GROUND	QQ		5.779	6.726	
504	20-Jun-84	GROUND	GROUND	QP		5.408	6.198	
505	20-Jun-84	GROUND	GROUND	QP		5.794	6.520	
506	20-Jun-84	GROUND	GROUND	QQ		6.386	6.878	
507	20-Jun-84	GROUND	GROUND	QQ		6.612	8.369	
508	20-Jun-84	GROUND	GROUND	AP		6.596	8.722	
509	20-Jun-84	GROUND	GROUND	AP		8.092	11.323	
510	20-Jun-84	GROUND	GROUND	AP		7.534	10.053	
511	20-Jun-84	GROUND	GROUND	AP		8.120	11.090	
512	20-Jun-84	GROUND	GROUND	AP		7.353	9.571	
513	20-Jun-84	GROUND	GROUND	AP		8.199	11.204	BEAKS-ERODED
514	20-Jun-84	GROUND	GROUND	AP		8.235	11.427	
515	20-Jun-84	GROUND	GROUND	AP		7.747	10.569	
516	20-Jun-84	GROUND	GROUND	AP		7.191	9.733	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
517	20-Jun-84	GROUND	GROUND	AP			7.615	10.495	
518	20-Jun-84	GROUND	GROUND	AP			5.771	7.297	
519	20-Jun-84	GROUND	GROUND	AP		DA	7.897	10.175	RT VALVE-CRACKED
520	20-Jun-84	GROUND	GROUND	LC			11.453	14.542	
521	20-Jun-84	GROUND	GROUND	MG			10.734	15.547	
522	20-Jun-84	GROUND	GROUND	PL			6.746	9.047	
523	20-Jun-84	PILING	GROUND	LF			7.059	9.924	
524	20-Jun-84	PILING	GROUND	LF			5.316	7.430	
525	20-Jun-84	PILING	GROUND	LF			6.119	9.177	
526	20-Jun-84	PILING	GROUND	LF			3.658	5.913	
527	20-Jun-84	PILING	GROUND	LF		DA	4.460	6.782	RT VALVE-CRACKED
528	20-Jun-84	PILING	GROUND	LF			5.728	8.115	
529	20-Jun-84	PILING	GROUND	LF			4.849	6.914	
530	20-Jun-84	PILING	GROUND	LF			5.575	8.100	
531	20-Jun-84	PILING	GROUND	PL			7.719	9.408	
532	20-Jun-84	PILING	GROUND	PL			5.753	7.374	
533	20-Jun-84	PILING	GROUND	LF			6.662	7.122	
534	20-Jun-84	PILING	GROUND	LF			4.364	6.584	
535	20-Jun-84	PILING	GROUND	LF			8.326	11.560	
536	20-Jun-84	PILING	GROUND	LF			4.399	6.226	
537	20-Jun-84	PILING	GROUND	LF			4.841	6.789	
538	20-Jun-84	PILING	GROUND	LF			3.800	4.188	
539	20-Jun-84	PILING	GROUND	PL			5.316	7.216	
540	20-Jun-84	PILING	GROUND	LF			4.216	6.198	
541	20-Jun-84	PILING	GROUND	LF			3.957	4.328	
542	20-Jun-84	PILING	GROUND	LF			6.754	9.700	
543	20-Jun-84	PILING	GROUND	PL			7.874	9.929	
544	20-Jun-84	PILING	GROUND	PL			4.978	6.934	
545	20-Jun-84	PILING	GROUND	LF			5.326	7.582	
546	20-Jun-84	PILING	GROUND	LF			4.326	6.426	
547	20-Jun-84	PILING	GROUND	LF			5.740	8.319	
548	20-Jun-84	PILING	UPSTRM	LF			3.965	6.330	
549	20-Jun-84	PILING	UPSTRM	LF			4.801	6.886	
550	20-Jun-84	PILING	GROUND	PL			4.788	6.599	LF VALVE-CARVED HOLE
551	20-Jun-84	PILING	UPSTRM	LF			6.226	8.981	
552	20-Jun-84	PILING	UPSTRM	LF			5.105	7.684	
553	20-Jun-84	PILING	UPSTRM	LF			5.075	7.379	
554	20-Jun-84	PILING	UPSTRM	LF			5.789	8.547	
555	20-Jun-84	PILING	UPSTRM	LF			6.195	9.284	
556	20-Jun-84	PILING	UPSTRM	LF			4.844	7.079	RT VALVE-CARVED HOLE
557	20-Jun-84	PILING	UPSTRM	LF			4.026	6.380	
558	20-Jun-84	PILING	UPSTRM	LF			4.394	9.868	
559	20-Jun-84	PILING	UPSTRM	LF			4.618	6.505	
560	20-Jun-84	PILING	UPSTRM	LF			5.065	7.976	
561	20-Jun-84	PILING	UPSTRM	LF			4.003	5.913	
562	20-Jun-84	PILING	UPSTRM	LF			4.402	6.619	
563	20-Jun-84	PILING	UPSTRM	LF			3.719	6.134	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
564	20-Jun-84	PILING	UPSTRM	LF			4.801	7.036	
565	20-Jun-84	PILING	UPSTRM	LF			4.818	6.579	
566	20-Jun-84	PILING	UPSTRM	LF			4.542	6.820	
567	20-Jun-84	PILING	UPSTRM	LF			6.010	8.839	
568	20-Jun-84	PILING	UPSTRM	LF			6.266	9.055	
569	20-Jun-84	PILING	UPSTRM	LF			4.613	6.817	
570	20-Jun-84	PILING	UPSTRM	LF			5.659	8.491	
571	20-Jun-84	PILING	UPSTRM	LF			3.264	5.014	BOTH VALVES-CARVED HOLES
572	20-Jun-84	PILING	UPSTRM	PL			5.042	7.178	
573	20-Jun-84	PILING	UPSTRM	PL			7.145	9.441	
574	20-Jun-84	PILING	UPSTRM	PL			5.959	8.192	
575	20-Jun-84	PILING	UPSTRM	PL			4.636	6.627	
576	20-Jun-84	PILING	UPSTRM	PL			4.935	6.711	
577	20-Jun-84	PILING	UPSTRM	PL			3.937	6.101	
578	20-Jun-84	PILING	UPSTRM	PL			4.978	6.703	
579	20-Jun-84	PILING	UPSTRM	PL			6.314	8.590	
580	20-Jun-84	PILING	UPSTRM	PL			4.338	6.281	
581	20-Jun-84	PILING	UPSTRM	PL			4.636	6.289	
582	20-Jun-84	PILING	UPSTRM	LT			3.978	8.082	
583	20-Jun-84	PILING	UPSTRM	LT		DA	3.673	8.433	LF VALVE-SLIGHT SCRAPE
584	21-Jun-84	PILING	GROUND	PL			6.068	8.044	
585	21-Jun-84	PILING	GROUND	PL			7.475	8.908	
586	21-Jun-84	PILING	GROUND	PL			3.256	4.402	
587	21-Jun-84	PILING	GROUND	PL			4.821	6.688	
588	21-Jun-84	PILING	GROUND	PL			3.429	4.618	
589	21-Jun-84	PILING	GROUND	PL			5.629	7.160	
590	21-Jun-84	PILING	GROUND	PL			3.160	4.206	
591	21-Jun-84	PILING	GROUND	PL			6.022	7.932	
592	21-Jun-84	PILING	GROUND	PL			5.428	7.188	
593	21-Jun-84	PILING	GROUND	PL			3.119	4.478	
594	21-Jun-84	PILING	GROUND	PL			5.725	7.480	
595	21-Jun-84	PILING	GROUND	PL			3.259	4.846	
596	21-Jun-84	PILING	GROUND	PL			9.436	10.879	
597	21-Jun-84	PILING	GROUND	PL			6.091	8.039	
598	21-Jun-84	PILING	GROUND	PL			5.659	7.798	
599	21-Jun-84	PILING	GROUND	PL			4.740	6.279	
600	21-Jun-84	PILING	GROUND	PL			5.494	7.315	
601	21-Jun-84	PILING	GROUND	PL			6.358	7.173	
602	21-Jun-84	PILING	GROUND	PL			6.383	9.012	
603	21-Jun-84	PILING	GROUND	PL			5.024	6.325	
604	21-Jun-84	PILING	GROUND	PL			7.846	10.605	
605	21-Jun-84	PILING	GROUND	PL			7.300	10.117	
606	21-Jun-84	PILING	GROUND	PL			3.073	4.712	
607	21-Jun-84	PILING	GROUND	LF			3.891	5.906	
608	21-Jun-84	PILING	GROUND	LF			5.939	9.078	
609	21-Jun-84	PILING	GROUND	LF			4.760	7.323	
610	21-Jun-84	PILING	GROUND	LF			7.325	10.516	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
611	21-Jun-84	PILING	GROUND	LF			4.788	7.325	
612	21-Jun-84	PILING	GROUND	LF			4.445	6.378	
613	21-Jun-84	PILING	GROUND	LF			4.745	7.257	
614	21-Jun-84	PILING	GROUND	LF			6.553	9.439	
615	21-Jun-84	PILING	GROUND	LF			4.793	7.620	
616	21-Jun-84	PILING	GROUND	LF			5.608	7.793	
617	21-Jun-84	PILING	GROUND	LF			6.784	9.817	
618	21-Jun-84	PILING	GROUND	LF		DA	5.298	7.557	RT VALVE-HOLE
619	21-Jun-84	PILING	GROUND	LF			4.153	7.470	
620	21-Jun-84	PILING	GROUND	PL			3.620	4.887	
621	21-Jun-84	PILING	GROUND	AI			2.781	5.141	
622	21-Jun-84	PILING	GROUND	PA			10.315	12.898	
623	21-Jun-84	PILING	GROUND	AI			2.850	5.545	
624	21-Jun-84	PILING	GROUND	PL			7.511	10.015	
625	21-Jun-84	PILING	GROUND	LT			4.326	9.718	
626	21-Jun-84	PILING	GROUND	A6			9.634	15.718	
627	21-Jun-84	GROUND	GROUND	LF			6.502	8.024	
628	21-Jun-84	GROUND	GROUND	LF			5.575	8.824	
629	21-Jun-84	GROUND	GROUND	AP			6.162	8.580	
630	21-Jun-84	GROUND	GROUND	AP			7.684	10.668	
631	21-Jun-84	GROUND	GROUND	AP			8.181	10.450	
632	21-Jun-84	GROUND	GROUND	AP			5.174	6.838	
633	21-Jun-84	GROUND	GROUND	AP			6.713	8.661	
634	21-Jun-84	GROUND	GROUND	AP			7.732	10.686	
635	21-Jun-84	GROUND	GROUND	AP			5.476	7.028	
636	21-Jun-84	GROUND	GROUND	AP			8.082	10.554	
637	21-Jun-84	GROUND	GROUND	AP			8.052	10.986	
638	21-Jun-84	GROUND	GROUND	AP			8.684	11.727	RT VALVE-SLIGHT EROSION
639	21-Jun-84	GROUND	GROUND	AP			7.737	11.151	RT BEAK-EROSION
640	21-Jun-84	GROUND	GROUND	AP			3.597	4.625	
641	21-Jun-84	GROUND	GROUND	QQ			5.177	6.093	
642	21-Jun-84	PILING	GROUND	LF			4.831	7.625	
643	21-Jun-84	GROUND	GROUND	QQ			5.499	6.802	
644	21-Jun-84	GROUND	GROUND	QQ			5.616	6.657	
645	21-Jun-84	GROUND	GROUND	QP			6.480	7.328	
646	21-Jun-84	GROUND	GROUND	PL			5.751	8.095	
647	21-Jun-84	GROUND	GROUND	PL			6.386	9.111	
648	21-Jun-84	GROUND	GROUND	PL			5.664	6.043	
649	21-Jun-84	GROUND	GROUND	LF			6.949	10.762	
650	21-Jun-84	GROUND	GROUND	PA			8.827	11.765	
651	21-Jun-84	GROUND	GROUND	LC		DA	11.201	14.135	LF BEAK-SCRAPE
652	21-Jun-84	GROUND	GROUND	AP			7.750	10.333	
653	21-Jun-84	GROUND	GROUND	AP			8.133	10.892	
654	21-Jun-84	GROUND	GROUND	AP			7.379	9.807	
655	21-Jun-84	GROUND	GROUND	AP		DA	7.658	10.516	RT VALVE-CHUNK MISSING
656	21-Jun-84	GROUND	GROUND	AP			7.704	10.246	
657	21-Jun-84	GROUND	GROUND	AP			8.402	11.201	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
658	21-Jun-84	GROUND	GROUND	AP		7.836	10.439	
659	21-Jun-84	GROUND	GROUND	AP		8.103	10.940	
660	21-Jun-84	GROUND	GROUND	AP		7.000	9.342	
661	21-Jun-84	GROUND	GROUND	AP		7.658	10.020	RT VALVE-EROSION
662	21-Jun-84	GROUND	GROUND	AP		7.503	10.787	
663	21-Jun-84	GROUND	GROUND	AP		6.322	8.235	
664	21-Jun-84	GROUND	GROUND	AP		7.737	10.485	
665	21-Jun-84	GROUND	GROUND	QQ		6.276	7.330	
666	21-Jun-84	GROUND	GROUND	QQ		6.126	7.475	
667	21-Jun-84	GROUND	GROUND	QP		5.796	6.561	
668	21-Jun-84	GROUND	GROUND	QP		5.994	6.563	
669	21-Jun-84	GROUND	GROUND	LF		4.933	7.163	FOUND ON SHORE NEAR PLOT 6
670	21-Jun-84	GROUND	GROUND	AP		8.862	12.002	
671	21-Jun-84	GROUND	GROUND	AP		8.476	11.364	BOTH VALVES-EROSION
672	21-Jun-84	GROUND	GROUND	AP		7.696	10.259	
673	22-Jun-84	GROUND	GROUND	AP		8.120	10.607	
674	22-Jun-84	GROUND	GROUND	AP		5.347	7.135	
675	22-Jun-84	GROUND	GROUND	AP		6.576	9.139	
676	22-Jun-84	GROUND	GROUND	AP		8.042	11.412	
677	22-Jun-84	GROUND	GROUND	AP		7.752	10.846	BEAKS-ERODED
678	22-Jun-84	GROUND	GROUND	AP		8.047	10.638	BEAKS-ERODED
679	22-Jun-84	GROUND	GROUND	AP		8.595	11.044	
680	22-Jun-84	GROUND	GROUND	AP		6.883	9.604	
681	22-Jun-84	GROUND	GROUND	AP		6.960	9.670	
682	22-Jun-84	GROUND	GROUND	AP		7.963	10.290	
683	22-Jun-84	GROUND	GROUND	AP		7.508	10.084	
684	22-Jun-84	GROUND	GROUND	AP	DA	7.338	10.046	POST LF VALVE-CRACKED
685	22-Jun-84	GROUND	GROUND	AP		7.521	10.744	
686	22-Jun-84	GROUND	GROUND	AP	DA	7.300	9.845	HINGE-DEFORMED AROUND
687	22-Jun-84	GROUND	GROUND	AP		7.394	9.517	
688	22-Jun-84	GROUND	GROUND	AP		3.035	3.975	
689	22-Jun-84	GROUND	GROUND	AP		3.439	4.252	
690	22-Jun-84	GROUND	GROUND	AP		4.539	5.685	
691	22-Jun-84	GROUND	GROUND	AP		7.214	9.736	
692	22-Jun-84	GROUND	GROUND	QP		5.850	6.302	
693	22-Jun-84	GROUND	GROUND	QP		5.380	5.799	
694	22-Jun-84	GROUND	GROUND	QQ		5.037	5.870	
695	22-Jun-84	GROUND	GROUND	QQ		5.197	6.520	
696	22-Jun-84	GROUND	GROUND	QP		5.464	6.020	
697	22-Jun-84	GROUND	GROUND	QP	DA	5.913	8.077	LF VALVE
698	22-Jun-84	GROUND	GROUND	PA		9.787	11.867	
699	22-Jun-84	GROUND	GROUND	PL		7.574	9.665	
700	22-Jun-84	GROUND	GROUND	QP		6.314	6.896	
701	22-Jun-84	GROUND	GROUND	FF		6.403	7.153	
702	22-Jun-84	GROUND	GROUND	QP		5.794	6.299	
703	22-Jun-84	GROUND	GROUND	QP		6.187	6.538	
704	22-Jun-84	GROUND	GROUND	QP		4.364	4.653	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
705	22-Jun-84	GROUND	GROUND	AP		6.342	8.547	
706	22-Jun-84	GROUND	GROUND	AP		5.753	10.704	
707	22-Jun-84	GROUND	GROUND	AP		8.529	11.026	
708	22-Jun-84	GROUND	GROUND	AP		8.166	11.262	
709	22-Jun-84	GROUND	GROUND	AP		7.590	10.224	
710	22-Jun-84	GROUND	GROUND	AP		6.767	8.524	
711	22-Jun-84	GROUND	GROUND	AP		7.422	10.251	
712	22-Jun-84	GROUND	GROUND	AP		6.726	9.093	
713	22-Jun-84	GROUND	GROUND	AP		7.381	10.008	
714	22-Jun-84	GROUND	GROUND	AP		8.204	10.940	
715	22-Jun-84	GROUND	GROUND	AP		7.953	10.780	
716	22-Jun-84	GROUND	GROUND	AP		6.309	8.545	
717	22-Jun-84	GROUND	GROUND	AP		7.572	9.779	
718	22-Jun-84	GROUND	GROUND	AP		8.202	11.019	
719	22-Jun-84	GROUND	GROUND	AP		7.463	9.716	
720	22-Jun-84	GROUND	GROUND	AP		7.346	9.749	
721	22-Jun-84	GROUND	GROUND	AP		7.254	10.015	
722	22-Jun-84	GROUND	GROUND	AP		6.604	9.642	
723	22-Jun-84	GROUND	GROUND	AP		8.722	11.847	
724	22-Jun-84	GROUND	GROUND	AP		7.945	10.996	LF VALVE-EROSION
725	22-Jun-84	GROUND	GROUND	AP		7.348	9.860	
726	22-Jun-84	GROUND	GROUND	AP		7.468	10.112	
727	22-Jun-84	GROUND	GROUND	AP		7.402	9.718	
728	22-Jun-84	GROUND	GROUND	AP		7.996	10.820	
729	22-Jun-84	GROUND	GROUND	AP		7.460	10.231	
730	22-Jun-84	GROUND	GROUND	AP		7.333	10.112	
731	22-Jun-84	GROUND	GROUND	AP		8.672	11.621	
732	22-Jun-84	GROUND	GROUND	AP		7.948	9.860	
733	22-Jun-84	GROUND	GROUND	AP		6.668	9.050	
734	22-Jun-84	GROUND	GROUND	AP		7.427	10.302	
735	22-Jun-84	GROUND	GROUND	AP		7.983	11.206	
736	22-Jun-84	GROUND	GROUND	AP		6.744	9.398	
737	22-Jun-84	GROUND	GROUND	AP		3.556	4.440	
738	22-Jun-84	GROUND	GROUND	QQ		6.101	7.310	
739	22-Jun-84	GROUND	GROUND	QQ		5.812	6.993	
740	22-Jun-84	GROUND	GROUND	QQ		6.083	6.861	
741	22-Jun-84	GROUND	GROUND	QQ		3.627	4.397	
742	22-Jun-84	GROUND	GROUND	QP		6.645	7.109	
743	22-Jun-84	GROUND	GROUND	QP		5.512	6.426	
744	22-Jun-84	GROUND	GROUND	QP		4.755	5.387	
745	22-Jun-84	GROUND	GROUND	QN		4.493	5.304	
746	22-Jun-84	GROUND	GROUND	QN		3.683	4.481	
747	22-Jun-84	GROUND	GROUND	QN		3.498	3.848	
748	22-Jun-84	GROUND	GROUND	OR		3.858	4.750	
749	04-Oct-85	GROUND	GROUND	AP	DA	3.377	4.351	? VALVE MOD SCRAPE
750	04-Oct-85	GROUND	GROUND	AP	DA	3.121	4.529	? VALVE SL SCRAPE
751	04-Oct-85	GROUND	GROUND	AP		3.308	4.569	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
752	04-Oct-85	GROUND	GROUND	AP		3.420	4.618	
753	04-Oct-85	GROUND	GROUND	AP		3.216	4.204	
754	04-Oct-85	GROUND	GROUND	AP	DA	2.903	3.986	? VALVE VERY SLIGHT SCRAPE
755	04-Oct-85	GROUND	GROUND	AP		3.342	4.652	
756	04-Oct-85	GROUND	GROUND	AP		2.861	3.912	
757	04-Oct-85	GROUND	GROUND	AP		3.149	4.229	
758	04-Oct-85	GROUND	GROUND	AP		3.171	4.210	
759	04-Oct-85	GROUND	GROUND	AP		3.096	4.415	
760	04-Oct-85	GROUND	GROUND	AP		3.176	4.418	
761	12-Jun-84	GROUND	GROUND	QQ		5.491	6.553	
762	12-Jun-84	GROUND	GROUND	QQ		7.000	7.523	
763	04-Oct-84	GROUND	GROUND	AP		7.788	11.013	
764	04-Oct-84	GROUND	GROUND	AP		7.343	10.460	
765	04-Oct-84	GROUND	GROUND	AP		8.666	11.473	
766	04-Oct-84	GROUND	GROUND	AP		6.660	8.565	
767	04-Oct-84	GROUND	GROUND	AP		7.493	9.972	
768	04-Oct-84	GROUND	GROUND	AP		5.560	7.244	
769	04-Oct-84	GROUND	GROUND	AP	DA	7.719	9.774	? VALVE, 2 RIDGES- SL SCRAPE
770	04-Oct-84	GROUND	GROUND	AP	DA	7.389	10.284	? VALVE, 3 RIDGES-SL SCRAPE
771	04-Oct-84	GROUND	GROUND	AP		7.615	10.579	
772	04-Oct-84	GROUND	GROUND	AP		8.573	12.156	
773	04-Oct-84	GROUND	GROUND	AP		6.518	8.837	
774	04-Oct-84	GROUND	GROUND	AP		6.477	8.689	
775	04-Oct-84	GROUND	GROUND	AP		7.584	12.482	
776	04-Oct-84	GROUND	GROUND	AP	DA	7.483	9.502	? VALVE, 1 RIDGE-SL SCRAPE
777	04-Oct-84	GROUND	GROUND	AP		8.044	11.407	
778	04-Oct-84	GROUND	GROUND	AP		8.926	12.591	
779	04-Oct-84	GROUND	GROUND	AP	DA	8.631	11.730	? VALVE,2 RIDGES-SL SCRAPE
780	04-Oct-84	GROUND	GROUND	AP	DA	7.549	10.338	UMBO-CHIPPED
781	04-Oct-84	GROUND	GROUND	AP		6.487	8.245	
782	04-Oct-84	GROUND	GROUND	AP		7.940	10.290	
783	04-Oct-84	GROUND	GROUND	AP		7.028	9.891	
784	04-Oct-84	GROUND	GROUND	AP		7.694	10.978	
785	04-Oct-84	GROUND	GROUND	AP		7.506	10.127	
786	04-Oct-84	GROUND	GROUND	AP	DA	8.359	10.983	? VALVE,2 RIDGES-SL SCRAPE
787	04-Oct-84	GROUND	GROUND	AP		7.940	10.439	
788	04-Oct-84	GROUND	GROUND	AP	DA	7.214	9.312	? VALVE,2 RIDGES-SL SCRAPE
789	04-Oct-84	GROUND	GROUND	AP		7.437	9.566	
790	04-Oct-84	GROUND	GROUND	AP		7.478	10.480	
791	04-Oct-84	GROUND	GROUND	AP		6.739	8.923	
792	04-Oct-84	GROUND	GROUND	AP		6.789	8.476	
793	04-Oct-84	GROUND	GROUND	AP		6.901	9.616	
794	04-Oct-84	GROUND	GROUND	AP		7.188	8.971	SHELL DEFORM,2 VAL OVERLAP(SHINGLE)
795	04-Oct-84	GROUND	GROUND	AP		6.883	10.168	
796	04-Oct-84	GROUND	GROUND	AP		6.347	8.151	
797	04-Oct-84	GROUND	GROUND	AP		6.467	8.598	
798	04-Oct-84	GROUND	GROUND	AP		6.271	8.204	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
799	04-Oct-84	GROUND	GROUND	AP		5.268	6.866	
800	04-Oct-84	GROUND	GROUND	AP		5.865	7.140	
801	04-Oct-84	GROUND	GROUND	AP		5.126	6.624	
802	04-Oct-84	GROUND	GROUND	AP		5.217	6.457	
803	04-Oct-84	GROUND	GROUND	AP		5.497	7.087	
804	04-Oct-84	GROUND	GROUND	AP		4.265	5.245	
805	04-Oct-84	GROUND	GROUND	QQ		5.497	6.297	
806	04-Oct-84	GROUND	GROUND	QQ		5.677	7.242	
807	04-Oct-84	GROUND	GROUND	QQ		5.715	6.637	
808	04-Oct-84	GROUND	GROUND	QQ		5.448	6.172	
809	04-Oct-84	GROUND	GROUND	QQ		4.679	5.624	
810	04-Oct-84	GROUND	GROUND	QQ		4.237	4.816	
811	04-Oct-84	GROUND	GROUND	QP		5.075	5.514	
812	04-Oct-84	GROUND	GROUND	QP	DA	5.756	6.543	? VALVE,VERY SL SCRAPE
813	04-Oct-84	GROUND	GROUND	QP	DA	5.829	6.086	? VALVE,SL SCRAPE
814	04-Oct-84	GROUND	GROUND	QP		5.784	6.373	
815	04-Oct-84	GROUND	GROUND	QP		6.160	6.447	
816	04-Oct-84	GROUND	GROUND	QP		5.687	5.959	
817	04-Oct-84	GROUND	GROUND	PA		10.361	13.531	
818	04-Oct-84	GROUND	GROUND	PA		6.363	8.661	
819	04-Oct-84	GROUND	GROUND	PA		6.967	9.060	
820	04-Oct-84	GROUND	GROUND	OR		4.115	5.408	
821	04-Oct-84	GROUND	GROUND	LF		5.763	8.567	
822	04-Oct-84	GROUND	GROUND	LF		4.412	6.581	
823	04-Oct-84	GROUND	GROUND	AP	DA	7.795	10.208	? VALVE,2 RIDGES-VERY SL SCRAPE
824	04-Oct-84	GROUND	GROUND	AP		7.592	10.099	
825	04-Oct-84	GROUND	GROUND	AP		8.014	10.930	
826	04-Oct-84	GROUND	GROUND	AP		7.788	10.190	
827	04-Oct-84	GROUND	GROUND	AP		7.572	10.338	
828	04-Oct-84	GROUND	GROUND	AP		6.566	9.129	
829	04-Oct-84	GROUND	GROUND	AP		6.802	8.329	
830	04-Oct-84	GROUND	GROUND	AP		6.584	8.405	
831	04-Oct-84	GROUND	GROUND	AP		6.279	7.734	
832	04-Oct-84	GROUND	GROUND	AP		6.472	7.772	
833	04-Oct-84	GROUND	GROUND	QP		6.160	6.619	
834	04-Oct-84	GROUND	GROUND	QP		6.309	7.277	
835	04-Oct-84	GROUND	GROUND	QP		5.550	6.477	
836	04-Oct-84	GROUND	GROUND	QP	DA	5.568	5.829	? VALVE,MOD SCRAPE
837	04-Oct-84	GROUND	GROUND	OR		3.538	4.539	
838	04-Oct-84	GROUND	GROUND	OR		2.951	3.566	
839	04-Oct-84	GROUND	GROUND	TT		3.452	4.384	
840	04-Oct-84	GROUND	GROUND	PA		5.469	7.300	
841	04-Oct-84	GROUND	GROUND	AP		7.219	9.723	
842	04-Oct-84	GROUND	GROUND	AP	DA	8.880	12.078	? VALVE,1 RIDGE-VERY SL SCRAPE
843	04-Oct-84	GROUND	GROUND	AP		8.270	11.288	
844	04-Oct-84	GROUND	GROUND	AP	DA	8.486	10.894	? VALVE,2 RIDGES-VERY SL SCRAPE
845	04-Oct-84	GROUND	GROUND	AP	DA	8.611	11.364	2 VALVES SCRAPED;1 W/SL;1 W/MOD

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
846	04-Oct-84	GROUND	GROUND	AP		7.303	9.558	
847	04-Oct-84	GROUND	GROUND	AP		7.366	9.690	
848	04-Oct-84	GROUND	GROUND	AP		7.117	9.903	
849	04-Oct-84	GROUND	GROUND	AP		9.934	10.447	
850	04-Oct-84	GROUND	GROUND	AP	DA	8.758	11.054	2 VALVES SCRAPED;1 W/MOD;1 W/SEV
851	04-Oct-84	GROUND	GROUND	AP		6.312	7.859	
852	04-Oct-84	GROUND	GROUND	AP		8.618	11.034	
853	04-Oct-84	GROUND	GROUND	AP		9.185	12.799	
854	04-Oct-84	GROUND	GROUND	AP		5.700	7.554	
855	04-Oct-84	GROUND	GROUND	AP		7.717	10.455	
856	04-Oct-84	GROUND	GROUND	AP		7.549	9.876	
857	04-Oct-84	GROUND	GROUND	AP		7.851	10.257	
858	04-Oct-84	GROUND	GROUND	AP		5.974	7.780	
859	04-Oct-84	GROUND	GROUND	AP		5.926	7.602	
860	04-Oct-84	GROUND	GROUND	AP		8.453	10.521	
861	04-Oct-84	GROUND	GROUND	AP		7.361	9.619	
862	04-Oct-84	GROUND	GROUND	AP		7.544	10.312	
863	04-Oct-84	GROUND	GROUND	AP		7.714	11.057	
864	04-Oct-84	GROUND	GROUND	AP		7.709	10.665	
865	04-Oct-84	GROUND	GROUND	AP		6.721	8.222	
866	04-Oct-84	GROUND	GROUND	AP		8.219	10.419	
867	04-Oct-84	GROUND	GROUND	AP		5.745	7.325	
868	04-Oct-84	GROUND	GROUND	AP		7.640	9.837	
869	04-Oct-84	GROUND	GROUND	AP		7.582	10.097	
870	04-Oct-84	GROUND	GROUND	AP		5.314	6.782	
871	04-Oct-84	GROUND	GROUND	AP		4.343	5.202	
872	04-Oct-84	GROUND	GROUND	AP		6.312	8.011	
873	04-Oct-84	GROUND	GROUND	AP		7.493	9.840	
874	04-Oct-84	GROUND	GROUND	AP	DA	7.125	9.398	? VALVE,2 RIDGES-SL SCRAPE
875	04-Oct-84	GROUND	GROUND	AP	DA	8.230	11.148	? VALVE,1 RIDGE-SL SCRAPE
876	04-Oct-84	GROUND	GROUND	AP		7.879	10.846	
877	04-Oct-84	GROUND	GROUND	AP	DA	7.894	10.023	2 VALVES SCRAPED;1 W/VERY SL;1 W/MOD
878	04-Oct-84	GROUND	GROUND	AP	DA	7.523	10.211	? VALVE,3 RIDGES-SL SCRAPE;SHINGLED
879	04-Oct-84	GROUND	GROUND	AP	DA	8.951	12.372	? VALVE,1 RIDGE-SL SCRAPE
880	04-Oct-84	GROUND	GROUND	AP		6.647	8.489	SHINGLED GROWTH
881	04-Oct-84	GROUND	GROUND	AP		6.124	7.567	
882	04-Oct-84	GROUND	GROUND	AP		5.652	7.206	
883	04-Oct-84	GROUND	GROUND	AP	DA	9.190	11.689	? VALVE,2 RIDGES-SL SCRAPE
884	04-Oct-84	GROUND	GROUND	AP		4.778	6.251	
885	04-Oct-84	GROUND	GROUND	AP		3.663	4.338	
886	04-Oct-84	GROUND	GROUND	AP		3.919	4.778	
887	04-Oct-84	GROUND	GROUND	QQ		6.690	7.798	
888	04-Oct-84	GROUND	GROUND	QQ		6.424	7.864	
889	04-Oct-84	GROUND	GROUND	QQ		5.933	6.680	
890	04-Oct-84	GROUND	GROUND	QQ		6.525	7.623	
891	04-Oct-84	GROUND	GROUND	QQ		5.794	6.350	
892	04-Oct-84	GROUND	GROUND	QQ		6.022	6.909	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
893	04-Oct-84	GROUND	GROUND	QQ		5.956	6.822	
894	04-Oct-84	GROUND	GROUND	QQ		7.376	5.771	MEASUREMENTS SUSPECT
895	04-Oct-84	GROUND	GROUND	QQ		4.750	5.448	
896	04-Oct-84	GROUND	GROUND	QP		4.851	5.372	
897	04-Oct-84	GROUND	GROUND	QP		5.685	6.124	
898	04-Oct-84	GROUND	GROUND	QN		4.961	5.677	
899	04-Oct-84	GROUND	GROUND	QN	DA	5.187	5.822	UMBOS CHIPPED
900	04-Oct-84	GROUND	GROUND	LF	DA	5.771	8.131	SHELL BROKEN & REGROWN
901	04-Oct-84	GROUND	GROUND	LT		4.661	10.480	SHINGLED GROWTH
902	04-Oct-84	GROUND	GROUND	OR		3.835	4.780	
903	04-Oct-84	GROUND	GROUND	AP		8.994	11.786	
904	04-Oct-84	GROUND	GROUND	AP	DA	8.270	10.638	? VALVE,2 RIDGES-MOD SCRAPE
905	04-Oct-84	GROUND	GROUND	AP		8.433	11.443	
906	04-Oct-84	GROUND	GROUND	AP	DA	8.031	10.754	? VALVE,1 RIDGE-SL SCRAPE
907	04-Oct-84	GROUND	GROUND	AP		7.803	9.967	
908	04-Oct-84	GROUND	GROUND	AP		7.313	10.427	
909	04-Oct-84	GROUND	GROUND	AP		7.582	10.135	
910	04-Oct-84	GROUND	GROUND	AP		8.506	11.090	
911	04-Oct-84	GROUND	GROUND	AP		8.359	10.930	
912	04-Oct-84	GROUND	GROUND	AP		8.443	10.643	
913	04-Oct-84	GROUND	GROUND	AP		8.217	11.288	DENTED & HEALED VENTRAL MARGIN
914	04-Oct-84	GROUND	GROUND	AP		7.082	9.040	
915	04-Oct-84	GROUND	GROUND	AP	DA	8.705	11.740	BOTH VALVES;1 W/SL;1 W/MOD
916	04-Oct-84	GROUND	GROUND	AP		7.178	9.426	
917	04-Oct-84	GROUND	GROUND	AP		8.854	12.009	
918	04-Oct-84	GROUND	GROUND	AP	DA	7.828	10.206	? VALVE,2 RIDGES-MOD SCRAPE
919	04-Oct-84	GROUND	GROUND	AP	DA	8.011	9.949	? VALVE,2 RIDGES-MOD SCRAPE
920	04-Oct-84	GROUND	GROUND	AP		7.518	10.099	
921	04-Oct-84	GROUND	GROUND	AP		7.173	9.591	
922	04-Oct-84	GROUND	GROUND	AP		7.849	10.645	
923	04-Oct-84	GROUND	GROUND	AP		8.146	10.780	
924	04-Oct-84	GROUND	GROUND	AP		8.092	10.566	
925	04-Oct-84	GROUND	GROUND	AP	DA	7.648	10.719	? VALVE CHIPPED NEAR DORSAL
926	04-Oct-84	GROUND	GROUND	AP		8.593	11.201	
927	04-Oct-84	GROUND	GROUND	AP	DA	7.412	10.170	? VALVE,1 RIDGE-VERY SL SCRAPE
928	04-Oct-84	GROUND	GROUND	AP		7.269	9.312	
929	04-Oct-84	GROUND	GROUND	AP		7.897	10.368	
930	04-Oct-84	GROUND	GROUND	AP		7.092	10.132	
931	04-Oct-84	GROUND	GROUND	AP		6.350	8.057	
932	04-Oct-84	GROUND	GROUND	AP	DA	7.645	10.312	? VALVE,2 RIDGES-VERY SL SCRAPE
933	04-Oct-84	GROUND	GROUND	AP	DA	8.306	10.312	? VALVE,3 RIDGES-SL SCRAPE
934	04-Oct-84	GROUND	GROUND	AP	DA	7.145	9.301	? VALVE,2 RIDGES-SL SCRAPE
935	04-Oct-84	GROUND	GROUND	AP		5.982	7.777	SHINGLED GROWTH
936	04-Oct-84	GROUND	GROUND	AP		7.587	10.028	
937	04-Oct-84	GROUND	GROUND	AP	DA	6.208	7.313	? VALVE CHIPPED NEAR DORSAL
938	04-Oct-84	GROUND	GROUND	AP		5.926	7.287	
939	04-Oct-84	GROUND	GROUND	AP		5.908	7.023	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
940	04-Oct-84	GROUND	GROUND	AP		5.598	7.023	
941	04-Oct-84	GROUND	GROUND	AP		5.298	6.688	
942	04-Oct-84	GROUND	GROUND	AP		5.128	6.330	
943	04-Oct-84	GROUND	GROUND	AP		3.660	4.702	
944	04-Oct-84	GROUND	GROUND	AP		4.011	4.981	
945	04-Oct-84	GROUND	GROUND	AP		3.477	4.285	
946	04-Oct-84	GROUND	GROUND	AP		3.929	4.686	
947	04-Oct-84	GROUND	GROUND	AP		3.363	4.079	
948	04-Oct-84	GROUND	GROUND	QQ		5.250	5.751	
949	04-Oct-84	GROUND	GROUND	QQ		5.197	6.134	
950	04-Oct-84	GROUND	GROUND	QQ		5.433	6.426	
951	04-Oct-84	GROUND	GROUND	QQ		4.128	4.727	
952	04-Oct-84	GROUND	GROUND	QQ		5.199	5.652	
953	04-Oct-84	GROUND	GROUND	AP		3.787	4.849	
954	04-Oct-84	GROUND	GROUND	QP		6.086	6.563	
955	04-Oct-84	GROUND	GROUND	QP		5.903	6.690	
956	04-Oct-84	GROUND	GROUND	QP		5.804	6.182	
957	04-Oct-84	GROUND	GROUND	QP		5.997	6.629	
958	04-Oct-84	GROUND	GROUND	QP	DA	5.822	6.350	? VALVE ,SL SCRAPE
959	04-Oct-84	GROUND	GROUND	QP		4.806	5.331	
960	04-Oct-84	GROUND	GROUND	QP		5.575	6.299	
961	04-Oct-84	GROUND	GROUND	QP		6.226	6.680	
962	04-Oct-84	GROUND	GROUND	QP	DA	4.874	5.603	? UMBO CHIPPED
963	04-Oct-84	GROUND	GROUND	QP	DA	5.522	5.900	? VALVE,MOD SCRAPE;SHINGLED GROWTH
964	04-Oct-84	GROUND	GROUND	PA		8.527	10.467	
965	04-Oct-84	GROUND	GROUND	PA		10.239	12.179	
966	04-Oct-84	GROUND	GROUND	QP		4.694	5.126	
967	04-Oct-84	GROUND	GROUND	QN		4.867	5.776	
968	04-Oct-84	GROUND	GROUND	QN		4.437	4.935	
969	04-Oct-84	GROUND	GROUND	QN		4.999	5.542	
970	04-Oct-84	GROUND	GROUND	QN		5.161	5.880	SHINGLED GROWTH
971	04-Oct-84	GROUND	GROUND	QN		5.502	6.543	
972	04-Oct-84	GROUND	GROUND	QN		4.389	4.895	
973	04-Oct-84	GROUND	GROUND	PL		5.928	7.417	
974	04-Oct-84	GROUND	GROUND	PL		6.406	9.241	
975	05-Oct-84	GROUND	GROUND	AP	DA	7.635	10.373	? VALVE,5 SCRAPES ON RIDGES
976	05-Oct-84	GROUND	GROUND	AP	DA	7.529	9.459	BOTH VALVES SCRAPED;1 W/MOD;1 W/SEV
977	05-Oct-84	GROUND	GROUND	AP	DA	7.920	11.128	BOTH VALVES W/SL SCRAPE
978	05-Oct-84	GROUND	GROUND	AP	DA	7.836	10.419	BOTH VALVES W/OLD DENT
979	05-Oct-84	GROUND	GROUND	AP		7.590	10.315	
980	05-Oct-84	GROUND	GROUND	AP		7.879	11.008	
981	05-Oct-84	GROUND	GROUND	AP		7.264	9.957	
982	05-Oct-84	GROUND	GROUND	AP	DA	7.917	10.884	BOTH VALVES SCRAPED;1 W/SL;1 W/MOD
983	05-Oct-84	GROUND	GROUND	AP		7.689	10.500	
984	05-Oct-84	GROUND	GROUND	AP		7.518	10.274	
985	04-Oct-84	GROUND	GROUND	OR		3.239	3.934	
986	05-Oct-84	GROUND	GROUND	AP		7.264	9.688	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
987	05-Oct-84	GROUND	GROUND	AP	DA	7.762	10.561	? VALVE,MOD SCRAPE
988	05-Oct-84	GROUND	GROUND	AP		7.056	9.665	
989	05-Oct-84	GROUND	GROUND	AP		6.807	8.471	
990	05-Oct-84	GROUND	GROUND	AP		8.471	11.798	
991	05-Oct-84	GROUND	GROUND	AP		7.938	11.026	
992	05-Oct-84	GROUND	GROUND	AP	DA	7.386	10.897	BOTH VALVES W/SL SCRAPES & 1 W/CHIP
993	05-Oct-84	GROUND	GROUND	AP		7.917	10.754	
994	05-Oct-84	GROUND	GROUND	AP		6.043	8.039	
995	05-Oct-84	GROUND	GROUND	AP		7.971	10.196	
996	05-Oct-84	GROUND	GROUND	AP		6.513	8.923	
997	05-Oct-84	GROUND	GROUND	AP		8.418	10.963	
998	05-Oct-84	GROUND	GROUND	AP	DA	7.234	10.137	? VALVE,SL SCRAPE
999	05-Oct-84	GROUND	GROUND	AP		5.832	7.656	
1000	05-Oct-84	GROUND	GROUND	AP	DA	8.606	11.257	BOTH VALVES W/SL SCRAPES
1001	05-Oct-84	GROUND	GROUND	AP		8.783	12.167	
1002	05-Oct-84	GROUND	GROUND	AP	DA	8.001	10.935	? VALVE,SL SCRAPE ON RIDGES
1003	05-Oct-84	GROUND	GROUND	AP	DA	7.861	11.151	OLD PUNCTURE IN 1 VALVE
1004	05-Oct-84	GROUND	GROUND	AP		7.785	10.185	
1005	05-Oct-84	GROUND	GROUND	AP		7.549	10.538	
1006	05-Oct-84	GROUND	GROUND	AP		8.458	11.438	
1007	05-Oct-84	GROUND	GROUND	AP		6.883	9.484	
1008	05-Oct-84	GROUND	GROUND	AP		7.125	9.296	
1009	05-Oct-84	GROUND	GROUND	AP		5.502	7.173	
1010	05-Oct-84	GROUND	GROUND	AP		8.573	11.326	NUMBERING MISTAKE SCRATCHED OUT
1011	05-Oct-84	GROUND	GROUND	AP	DA	7.607	10.688	BOTH VALVES W/SL SCRAPE ON RIDGES
1012	05-Oct-84	GROUND	GROUND	AP	DA	8.402	11.290	? VAL,2 RIDGES-SL SCRAPE & UMBOS CHIPPED
1013	05-Oct-84	GROUND	GROUND	AP	DA	8.616	11.722	? VALVE,OLD CHIP
1014	05-Oct-84	GROUND	GROUND	AP	DA	7.531	9.809	? VALVE,SL SCRAPE
1015	05-Oct-84	GROUND	GROUND	AP		8.496	11.110	
1016	05-Oct-84	GROUND	GROUND	AP		5.220	6.375	
1017	05-Oct-84	GROUND	GROUND	AP		4.618	5.652	
1018	05-Oct-84	GROUND	GROUND	AP		7.290	9.561	
1019	05-Oct-84	GROUND	GROUND	AP		5.728	7.518	
1020	05-Oct-84	GROUND	GROUND	AP		5.362	7.112	
1021	05-Oct-84	GROUND	GROUND	AP		4.018	5.232	
1022	05-Oct-84	GROUND	GROUND	AP		6.731	8.430	
1023	05-Oct-84	GROUND	GROUND	AP		5.491	7.244	
1024	05-Oct-84	GROUND	GROUND	AP		7.493	9.850	
1025	05-Oct-84	GROUND	GROUND	AP		4.841	5.842	
1026	05-Oct-84	GROUND	GROUND	AP		4.663	5.715	
1027	05-Oct-84	GROUND	GROUND	PA		10.871	14.094	
1028	05-Oct-84	GROUND	GROUND	PA		8.542	12.421	
1029	05-Oct-84	GROUND	GROUND	FF		5.669	6.939	
1030	05-Oct-84	GROUND	GROUND	LF		5.461	7.783	
1031	05-Oct-84	GROUND	GROUND	QN		3.670	4.445	
1032	05-Oct-84	GROUND	GROUND	QN		4.625	5.309	
1033	05-Oct-84	GROUND	GROUND	AP		2.855	3.757	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1034	05-Oct-84	GROUND	GROUND	LT		2.413	5.705	
1035	05-Oct-84	GROUND	GROUND	QN		3.434	3.810	
1036	05-Oct-84	GROUND	GROUND	PL		7.869	11.316	
1037	05-Oct-84	GROUND	GROUND	PL		7.808	9.865	
1038	05-Oct-84	GROUND	GROUND	PL		5.674	7.648	
1039	05-Oct-84	GROUND	GROUND	QQ		6.055	6.695	
1040	05-Oct-84	GROUND	GROUND	QQ		4.328	5.001	
1041	05-Oct-84	GROUND	GROUND	QP		6.253	6.871	
1042	05-Oct-84	GROUND	GROUND	QP		5.903	6.502	
1043	05-Oct-84	GROUND	GROUND	QP		5.344	5.796	
1044	05-Oct-84	GROUND	GROUND	QP		5.433	5.829	
1045	05-Oct-84	GROUND	GROUND	QP		4.442	4.973	
1046	05-Oct-84	GROUND	GROUND	QP		5.306	5.667	
1047	05-Oct-84	GROUND	GROUND	QP		5.387	6.066	
1048	05-Oct-84	GROUND	GROUND	QP		4.859	5.415	
1049	05-Oct-84	GROUND	GROUND	QP		5.855	6.350	
1050	05-Oct-84	GROUND	GROUND	QR		3.312	4.237	
1051	06-Oct-84	UPSTRM	GROUND	AP	DA	6.012	7.788	LFT VALVE,1 RIDGE-MOD SCRAPE
1052	06-Oct-84	UPSTRM	GROUND	AP	DA	6.690	8.405	RT VALVE,1 RIDGE-SL SCRAPE
1053	06-Oct-84	UPSTRM	GROUND	AP	DA	8.319	11.534	2 VALVES W/SL SCRAPE & LFT VALVE W/CHIP
1054	06-Oct-84	UPSTRM	GROUND	AP	DA	6.922	8.903	RT VALVE,SL SCRAPE
1055	06-Oct-84	UPSTRM	GROUND	AP	DA	6.431	7.899	LFT VALVE W/MOD SCRAPE;SHINGLED GROWTH
1056	06-Oct-84	UPSTRM	GROUND	AP	DA	7.658	10.564	RT VALVE W/MOD SCRAPE
1057	06-Oct-84	UPSTRM	GROUND	AP	DA	6.937	8.308	LFT VALVE W/SL SCRAPE
1058	06-Oct-84	UPSTRM	GROUND	AP	DA	6.787	8.519	RT VALVE W/SL SCRAPE
1059	06-Oct-84	UPSTRM	GROUND	PA		10.302	12.200	
1060	06-Oct-84	UPSTRM	GROUND	PA		11.206	13.810	
1061	06-Oct-84	UPSTRM	GROUND	AG	DA	9.159	14.115	LFT VALVE CRACKED ANT TO POST
1062	06-Oct-84	UPSTRM	GROUND	AG	DA	10.018	14.463	RT VAL W/PUNCTURE NEAR BEAK & SL SCRAPE
1063	06-Oct-84	UPSTRM	GROUND	AP		4.552	5.804	
1064	06-Oct-84	UPSTRM	GROUND	AP	DA	6.038	7.638	BOTH UMBOS W/SL SCRAPE
1065	06-Oct-84	UPSTRM	GROUND	AP	DA	8.418	11.486	LFT VALVE W/SL SCRAPE ;BEAKS ERODED
1066	06-Oct-84	UPSTRM	GROUND	AP		3.828	4.686	
1067	06-Oct-84	UPSTRM	GROUND	AP		7.224	9.820	
1068	06-Oct-84	UPSTRM	GROUND	AP		4.232	5.144	
1069	06-Oct-84	UPSTRM	GROUND	AP		4.018	4.930	
1070	06-Oct-84	UPSTRM	GROUND	AP		3.823	4.686	
1071	06-Oct-84	UPSTRM	GROUND	AP		6.050	7.948	
1072	06-Oct-84	UPSTRM	GROUND	AP		7.851	10.485	
1073	06-Oct-84	UPSTRM	GROUND	AP		6.017	7.821	SHINGLED GROWTH
1074	06-Oct-84	UPSTRM	GROUND	AG		10.345	15.753	
1075	06-Oct-84	UPSTRM	GROUND	AG		8.854	14.181	
1076	06-Oct-84	UPSTRM	GROUND	AG		8.407	13.444	
1077	06-Oct-84	UPSTRM	GROUND	AG		8.877	14.196	
1078	06-Oct-84	UPSTRM	GROUND	AG		7.927	12.901	
1079	06-Oct-84	UPSTRM	GROUND	AG		8.263	14.783	
1080	06-Oct-84	UPSTRM	GROUND	AG		9.307	14.135	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1081	06-Oct-84	UPSTRM	GROUND	AG			8.319	13.332	
1082	06-Oct-84	UPSTRM	GROUND	AG			9.114	13.551	
1083	06-Oct-84	UPSTRM	GROUND	AG			5.192	8.131	
1084	06-Oct-84	UPSTRM	GROUND	AG			6.154	9.497	SHINGLED GROWTH
1085	06-Oct-84	UPSTRM	GROUND	AG			4.674	7.727	
1086	06-Oct-84	UPSTRM	GROUND	LC			9.680	10.978	
1087	06-Oct-84	UPSTRM	GROUND	PA			10.216	11.742	
1088	06-Oct-84	UPSTRM	GROUND	PA			10.831	13.848	LFT VALVE DENTED
1089	06-Oct-84	UPSTRM	GROUND	PA		DA	10.742	13.574	WING CHIPPED
1090	06-Oct-84	UPSTRM	GROUND	PA			10.526	13.975	
1091	06-Oct-84	UPSTRM	GROUND	PA			8.692	11.072	
1092	06-Oct-84	UPSTRM	GROUND	PA			8.087	10.175	
1093	06-Oct-84	UPSTRM	GROUND	PA			9.467	11.908	
1094	06-Oct-84	UPSTRM	GROUND	PA			10.996	15.194	
1095	06-Oct-84	UPSTRM	GROUND	PA			7.534	9.263	
1096	06-Oct-84	UPSTRM	GROUND	PA			9.837	11.900	
1097	06-Oct-84	UPSTRM	GROUND	PL			8.072	10.551	
1098	06-Oct-84	UPSTRM	GROUND	PL			7.734	10.236	
1099	06-Oct-84	UPSTRM	GROUND	PL			6.754	9.068	
1100	06-Oct-84	UPSTRM	GROUND	PL			7.920	10.381	
1101	06-Oct-84	UPSTRM	GROUND	PL			7.201	9.464	
1102	06-Oct-84	UPSTRM	GROUND	PL			6.068	10.683	
1103	06-Oct-84	UPSTRM	GROUND	PL			6.551	8.387	
1104	06-Oct-84	UPSTRM	GROUND	PL			5.822	7.117	
1105	06-Oct-84	UPSTRM	GROUND	PL			4.836	6.246	
1106	06-Oct-84	UPSTRM	GROUND	PL			5.568	6.990	
1107	06-Oct-84	UPSTRM	GROUND	PL			4.092	5.359	
1108	06-Oct-84	UPSTRM	GROUND	PL			4.061	5.354	
1109	06-Oct-84	UPSTRM	GROUND	PL			4.630	5.880	
1110	06-Oct-84	UPSTRM	GROUND	PL			4.341	5.164	
1111	06-Oct-84	UPSTRM	GROUND	LC			8.451	9.418	
1112	06-Oct-84	UPSTRM	GROUND	PA			4.361	4.978	
1113	06-Oct-84	UPSTRM	GROUND	LF			4.493	6.551	
1114	06-Oct-84	UPSTRM	GROUND	LF			4.592	6.970	
1115	06-Oct-84	UPSTRM	GROUND	LT			4.351	9.782	
1116	06-Oct-84	UPSTRM	GROUND	LT			4.564	9.106	
1117	06-Oct-84	UPSTRM	GROUND	LT		DA	3.139	7.313	LFT VALVE W/SL SCRAPE
1118	06-Oct-84	UPSTRM	GROUND	LF			3.109	4.684	
1119	06-Oct-84	UPSTRM	GROUND	AC			5.939	7.838	
1120	06-Oct-84	UPSTRM	GROUND	AC			6.563	8.580	
1121	06-Oct-84	UPSTRM	GROUND	AC			5.436	6.942	
1122	06-Oct-84	UPSTRM	GROUND	QQ			5.166	5.880	
1123	06-Oct-84	UPSTRM	GROUND	QQ			4.011	4.562	
1124	06-Oct-84	UPSTRM	GROUND	AG			4.097	6.490	
1125	06-Oct-84	UPSTRM	GROUND	AP			2.040	2.416	
1126	06-Oct-84	GROUND	GROUND	AP		DA	7.435	10.279	CHIPPED UMBOS
1127	06-Oct-84	GROUND	GROUND	AP			8.006	11.321	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1128	06-Oct-84	GROUND	GROUND	AP			7.831	10.757	
1129	06-Oct-84	GROUND	GROUND	AP			7.414	10.079	
1130	06-Oct-84	GROUND	GROUND	AP		DA	8.103	11.273	RT VALVE W/SL SCRAPE
1131	06-Oct-84	GROUND	GROUND	AP		DA	8.021	11.031	BOTH VALVES W/SL SCRAPE
1132	06-Oct-84	GROUND	GROUND	AP		DA	7.356	9.881	LFT VALVE W/MOD SCRAPE
1133	06-Oct-84	GROUND	GROUND	AP		DA	6.678	9.441	LFT VALVE W/3 CHIPS
1134	06-Oct-84	GROUND	GROUND	AP		DA	5.652	7.798	LFT VALVE W/SL SCRAPE
1135	06-Oct-84	GROUND	GROUND	AP		DA	7.137	9.845	LFT VALVE W/SMALL CHIPS
1136	06-Oct-84	GROUND	GROUND	PA		DA	8.136	10.612	LFT VALVE W/SL SCRAPE
1137	06-Oct-84	GROUND	GROUND	PL			3.406	5.141	
1138	06-Oct-84	GROUND	GROUND	QQ			5.916	7.082	
1139	06-Oct-84	GROUND	GROUND	QQ			3.965	4.318	
1140	06-Oct-84	GROUND	GROUND	QP			5.677	6.398	
1141	06-Oct-84	GROUND	GROUND	QN			5.075	5.989	
1142	07-Oct-84	DWNSTRM	DWNSTRM	QP			5.425	5.415	
1143	07-Oct-84	DWNSTRM	DWNSTRM	QP			5.070	5.550	
1144	07-Oct-84	DWNSTRM	DWNSTRM	LF			2.819	4.191	
1145	07-Oct-84	DWNSTRM	DWNSTRM	LF			3.416	5.278	
1146	07-Oct-84	DWNSTRM	DWNSTRM	AP			5.311	7.221	
1147	07-Oct-84	DWNSTRM	DWNSTRM	LF			5.413	7.851	BOTH VALVES DEFORMED
1148	07-Oct-84	DWNSTRM	DWNSTRM	LF			5.527	8.781	
1149	07-Oct-84	DWNSTRM	DWNSTRM	AP			6.355	8.334	
1150	07-Oct-84	DWNSTRM	DWNSTRM	AP			3.322	4.008	
1151	07-Oct-84	DWNSTRM	DWNSTRM	AP			5.448	6.810	
1152	07-Oct-84	DWNSTRM	DWNSTRM	AP			5.484	7.137	
1153	07-Oct-84	DWNSTRM	DWNSTRM	AP			6.830	9.073	
1154	07-Oct-84	DWNSTRM	DWNSTRM	AP			5.984	7.823	
1155	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.468	9.718	
1156	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.051	9.083	
1157	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.201	8.910	
1158	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.000	6.477	MEASUREMENTS SUSPECT
1159	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.468	9.855	
1160	07-Oct-84	DWNSTRM	DWNSTRM	AP			6.934	9.276	
1161	07-Oct-84	DWNSTRM	DWNSTRM	AP			8.082	10.790	
1162	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.087	9.700	
1163	07-Oct-84	DWNSTRM	DWNSTRM	AP			7.442	10.719	
1164	07-Oct-84	DWNSTRM	DWNSTRM	AP			8.240	10.973	
1165	07-Oct-84	DWNSTRM	DWNSTRM	PA		DA	10.632	13.147	BOTH VALVES BROKEN;OLD
1166	07-Oct-84	DWNSTRM	DWNSTRM	PA			9.004	10.554	
1167	07-Oct-84	DWNSTRM	DWNSTRM	QQ			5.128	5.878	
1168	07-Oct-84	DWNSTRM	DWNSTRM	LT			6.177	12.789	
1169	07-Oct-84	DWNSTRM	DWNSTRM	PL			6.899	9.446	
1170	07-Oct-84	DWNSTRM	GROUND	AP		DA	8.359	10.617	RT VALVE ,1 RIDGE-SL SCRAPE
1171	07-Oct-84	DWNSTRM	GROUND	AP			7.976	10.363	
1172	07-Oct-84	DWNSTRM	GROUND	AP			7.904	10.952	RT VALVE EROSION
1173	07-Oct-84	DWNSTRM	GROUND	AP			7.371	10.894	
1174	07-Oct-84	DWNSTRM	GROUND	AP			8.270	10.719	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1175	07-Oct-84	DWNSTRM	GROUND	AP		7.468	10.201	
1176	07-Oct-84	DWNSTRM	GROUND	AP		6.858	8.750	
1177	07-Oct-84	DWNSTRM	GROUND	AP		7.696	10.526	
1178	07-Oct-84	DWNSTRM	GROUND	AP		7.092	8.974	
1179	07-Oct-84	DWNSTRM	GROUND	AP		8.235	10.775	
1180	07-Oct-84	DWNSTRM	GROUND	AP		7.717	10.485	
1181	07-Oct-84	DWNSTRM	GROUND	AP		7.719	10.297	
1182	07-Oct-84	DWNSTRM	DWNSTRM	AP		6.848	8.931	
1183	07-Oct-84	DWNSTRM	GROUND	AP		7.699	11.011	
1184	07-Oct-84	DWNSTRM	GROUND	AP		6.906	8.852	
1185	07-Oct-84	DWNSTRM	GROUND	AP		8.379	11.720	BOTH VALVES W/SL EROSION
1186	07-Oct-84	DWNSTRM	GROUND	AP		4.237	5.311	
1187	07-Oct-84	DWNSTRM	DWNSTRM	PL		7.325	9.911	
1188	07-Oct-84	DWNSTRM	GROUND	LF		6.909	9.596	
1189	07-Oct-84	DWNSTRM	GROUND	AG		5.563	7.650	
1190	07-Oct-84	DWNSTRM	GROUND	LF		7.943	13.305	
1191	07-Oct-84	DWNSTRM	DWNSTRM	QQ		6.571	7.894	
1192	07-Oct-84	DWNSTRM	GROUND	QQ		5.283	6.528	
1193	07-Oct-84	DWNSTRM	DWNSTRM	QQ		3.848	4.343	
1194	07-Oct-84	DWNSTRM	GROUND	QQ		3.241	3.774	
1195	07-Oct-84	DWNSTRM	DWNSTRM	QP		4.483	5.372	
1196	08-Oct-84	GROUND	GROUND	AP		8.199	11.504	BEAKS ERODED
1197	08-Oct-84	GROUND	GROUND	AP	DA	7.158	9.972	LFT VALVE W/MOD SCRAPE
1198	08-Oct-84	GROUND	GROUND	AP	DA	7.419	10.437	LFT VALVE W/SL SCRAPE
1199	08-Oct-84	GROUND	GROUND	AP		8.209	11.453	
1200	08-Oct-84	GROUND	GROUND	AP		8.242	11.283	
1201	08-Oct-84	GROUND	GROUND	AP		7.963	10.815	
1202	08-Oct-84	GROUND	GROUND	AP		7.447	10.005	
1203	08-Oct-84	GROUND	GROUND	AP		7.610	10.533	
1204	08-Oct-84	GROUND	GROUND	AP		8.321	11.214	
1205	08-Oct-84	GROUND	GROUND	AP	DA	7.701	10.147	LFT VALVE W/MOD SCRAPE
1206	08-Oct-84	GROUND	GROUND	AP		7.300	10.475	
1207	08-Oct-84	GROUND	GROUND	AP		8.308	10.770	
1208	08-Oct-84	GROUND	GROUND	AP		7.170	10.025	
1209	08-Oct-84	GROUND	GROUND	AP	DA	7.155	9.426	LFT VALVE W/SL SCRAPE
1210	08-Oct-84	GROUND	GROUND	AP	DA	6.957	9.220	RT VALVE CHIPPED
1211	08-Oct-84	GROUND	GROUND	AP		7.336	10.132	
1212	08-Oct-84	GROUND	GROUND	AP		7.938	10.607	
1213	08-Oct-84	GROUND	GROUND	AP	DA	6.833	9.769	RT VALVE W/RIDGES CHIPPED
1214	08-Oct-84	GROUND	GROUND	AP		7.396	9.390	
1215	08-Oct-84	GROUND	GROUND	AP		6.822	9.342	BEAKS ERODED
1216	08-Oct-84	GROUND	GROUND	AP		8.423	11.341	RIDGES ERODED
1217	08-Oct-84	GROUND	GROUND	AP		7.518	10.409	
1218	08-Oct-84	GROUND	GROUND	AP		7.493	10.218	
1219	08-Oct-84	GROUND	GROUND	AP	DA	7.127	9.749	BEAKS CHIPPED SLIGHTLY
1220	08-Oct-84	GROUND	GROUND	AP		6.695	8.979	
1221	08-Oct-84	GROUND	GROUND	AP		6.401	8.717	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1222	08-Oct-84	GROUND	GROUND	AP			6.396	8.009	
1223	08-Oct-84	GROUND	GROUND	AP			6.652	8.105	
1224	08-Oct-84	GROUND	GROUND	AP			5.441	7.150	
1225	08-Oct-84	GROUND	GROUND	AP			5.789	7.282	
1226	08-Oct-84	GROUND	GROUND	AP			3.195	3.858	
1227	08-Oct-84	GROUND	GROUND	QP			6.391	6.835	
1228	08-Oct-84	GROUND	GROUND	QP			6.330	7.018	
1229	08-Oct-84	GROUND	GROUND	QP		DA	6.586	6.594	RT VALVE CHIPPED
1230	08-Oct-84	GROUND	GROUND	QP			6.091	6.266	
1231	08-Oct-84	GROUND	GROUND	QP			5.662	6.243	
1232	08-Oct-84	GROUND	GROUND	QP			5.184	5.728	
1233	08-Oct-84	GROUND	GROUND	LC			11.090	14.110	
1234	08-Oct-84	GROUND	GROUND	QQ			6.210	7.330	
1235	08-Oct-84	GROUND	GROUND	QQ			5.748	6.845	
1236	08-Oct-84	GROUND	GROUND	QQ			6.386	7.414	
1237	08-Oct-84	GROUND	GROUND	QQ			5.227	6.467	
1238	08-Oct-84	GROUND	GROUND	QQ			6.223	7.381	
1239	08-Oct-84	GROUND	GROUND	QQ			5.682	6.855	
1240	08-Oct-84	GROUND	GROUND	QQ			5.890	6.861	
1241	08-Oct-84	GROUND	GROUND	QQ			5.771	7.135	
1242	08-Oct-84	GROUND	GROUND	QQ			5.131	5.956	
1243	08-Oct-84	GROUND	GROUND	AP			7.557	10.089	
1244	08-Oct-84	GROUND	GROUND	AP			8.141	10.945	BOTH VALVES ERODED
1245	08-Oct-84	GROUND	GROUND	AP			8.512	11.829	BOTH VALVES ERODED
1246	08-Oct-84	GROUND	GROUND	AP			7.551	10.142	
1247	08-Oct-84	GROUND	GROUND	AP			7.643	10.396	BOTH BEAKS W/SL EROSION
1248	08-Oct-84	GROUND	GROUND	AP			6.584	8.468	
1249	08-Oct-84	GROUND	GROUND	AP			7.036	10.394	BOTH BEAKS W/SL EROSION
1250	08-Oct-84	GROUND	GROUND	AP			6.777	9.263	BOTH BEAKS W/SL EROSION
1251	08-Oct-84	GROUND	GROUND	AP			5.847	7.521	RT VALVE W/EXTRA MARK,DUE TO US(INHS)
1252	08-Oct-84	GROUND	GROUND	QN			5.062	5.903	
1253	08-Oct-84	GROUND	GROUND	QN			3.627	3.998	
1254	08-Oct-84	GROUND	GROUND	QN			3.348	3.785	
1255	08-Oct-84	GROUND	GROUND	PA			7.938	9.454	
1256	08-Oct-84	GROUND	GROUND	FF			6.701	7.196	BOTH VALVES W/EROSION
1257	08-Oct-84	GROUND	GROUND	QQ			3.226	3.729	
1258	08-Oct-84	GROUND	GROUND	LF			6.429	9.390	
1259	08-Oct-84	GROUND	GROUND	LF			5.141	7.684	
1260	08-Oct-84	GROUND	GROUND	QP			6.284	6.640	
1261	08-Oct-84	GROUND	GROUND	QP			6.015	6.617	
1262	08-Oct-84	GROUND	GROUND	QP			5.771	6.523	
1263	08-Oct-84	GROUND	GROUND	QP			5.235	5.654	
1264	08-Oct-84	GROUND	GROUND	QP			5.852	6.099	
1265	08-Oct-84	GROUND	GROUND	QP			5.415	6.182	
1266	08-Oct-84	GROUND	GROUND	QP			5.146	5.682	
1267	08-Oct-84	GROUND	GROUND	QP			4.829	5.392	
1268	08-Oct-84	GROUND	GROUND	QP			4.061	4.346	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1269	08-Oct-84	GROUND	GROUND	QP		4.389	4.689	
1270	08-Oct-84	GROUND	GROUND	QP		6.223	7.018	
1271	08-Oct-84	GROUND	GROUND	QP		5.718	6.091	
1272	08-Oct-84	GROUND	GROUND	LF		4.760	6.828	
1273	08-Oct-84	GROUND	GROUND	OR		4.056	4.630	
1274	08-Oct-84	GROUND	GROUND	QQ		5.204	6.236	
1275	08-Oct-84	GROUND	GROUND	AP		8.446	11.234	
1276	08-Oct-84	GROUND	GROUND	AP		7.988	10.762	
1277	08-Oct-84	GROUND	GROUND	AP		7.579	10.513	
1278	08-Oct-84	GROUND	GROUND	AP		7.656	10.424	BOTH VALVES W/SEV EROSION
1279	08-Oct-84	GROUND	GROUND	AP		7.689	10.287	
1280	08-Oct-84	GROUND	GROUND	AP		7.783	10.475	
1281	08-Oct-84	GROUND	GROUND	AP		7.193	9.644	BOTH VALVES W/EROSION
1282	08-Oct-84	GROUND	GROUND	AP		7.005	8.951	
1283	08-Oct-84	GROUND	GROUND	AP		5.761	7.473	
1284	08-Oct-84	GROUND	GROUND	QP		6.287	7.031	
1285	08-Oct-84	GROUND	GROUND	AP	DA	7.935	10.759	BOTH VALVES
1286	08-Oct-84	GROUND	GROUND	AP		7.638	10.401	
1287	08-Oct-84	GROUND	GROUND	AP	DA	7.991	10.813	LFT VALVE SCRAPED & CHIPPED
1288	08-Oct-84	GROUND	GROUND	AP		9.360	12.781	
1289	08-Oct-84	GROUND	GROUND	AP		7.925	10.861	
1290	08-Oct-84	GROUND	GROUND	AP		7.450	10.264	
1291	08-Oct-84	GROUND	GROUND	AP		7.760	10.401	
1292	08-Oct-84	GROUND	GROUND	AP		7.544	10.843	
1293	08-Oct-84	GROUND	GROUND	AP		7.234	9.497	
1294	08-Oct-84	GROUND	GROUND	AP		7.059	9.700	
1295	08-Oct-84	GROUND	GROUND	AP		8.971	12.469	
1296	08-Oct-84	GROUND	GROUND	AP		7.539	10.229	
1297	08-Oct-84	GROUND	GROUND	AP	DA	7.546	10.414	LFT VALVE SCRAPED
1298	08-Oct-84	GROUND	GROUND	AP	DA	7.861	10.787	RT VALVE-PROP CUT
1299	08-Oct-84	GROUND	GROUND	AP		6.861	9.596	
1300	08-Oct-84	GROUND	GROUND	AP		7.877	11.633	
1301	08-Oct-84	GROUND	GROUND	AP		7.313	9.741	
1302	08-Oct-84	GROUND	GROUND	AP		5.662	7.209	
1303	08-Oct-84	GROUND	GROUND	AP		5.349	6.711	
1304	08-Oct-84	GROUND	GROUND	QP		6.195	6.497	
1305	08-Oct-84	GROUND	GROUND	QP		5.931	6.226	
1306	08-Oct-84	GROUND	GROUND	QP		5.306	5.809	
1307	08-Oct-84	GROUND	GROUND	QP		5.245	5.705	
1308	08-Oct-84	GROUND	GROUND	QP		5.118	5.753	
1309	08-Oct-84	GROUND	GROUND	OR		3.401	4.244	
1310	08-Oct-84	GROUND	GROUND	QQ		3.924	4.585	
1311	08-Oct-84	GROUND	GROUND	QN		4.801	5.354	
1312	08-Oct-84	GROUND	GROUND	LF		5.329	8.334	
1313	08-Oct-84	GROUND	GROUND	PL		6.480	8.613	
1314	08-Oct-84	GROUND	GROUND	PL		7.127	8.839	
1315	08-Oct-84	GROUND	GROUND	PL		6.269	8.758	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1316	08-Oct-84	GROUND	GROUND	PL		5.316	7.539	
1317	08-Oct-84	GROUND	GROUND	PL		6.276	8.715	SCRAPE DUE TO US(INHS)
1318	08-Oct-84	GROUND	GROUND	PA		10.315	14.120	
1319	08-Oct-84	GROUND	GROUND	PA		9.627	11.735	
1320	08-Oct-84	GROUND	GROUND	AP		8.171	10.973	
1321	08-Oct-84	GROUND	GROUND	AP		8.532	11.654	BOTH VALVES W/EROSION
1322	08-Oct-84	GROUND	GROUND	AP		7.201	9.797	BOTH VALVES W/EROSION
1323	08-Oct-84	GROUND	GROUND	AP	DA	7.595	10.259	LFT VALVE W/SL SCRAPE
1324	08-Oct-84	GROUND	GROUND	AP		8.486	11.453	
1325	08-Oct-84	GROUND	GROUND	AP		8.014	10.757	LFT BEAK W/EROSION
1326	08-Oct-84	GROUND	GROUND	AP	DA	8.306	10.671	LFT VALVE W/SL SCRAPE
1327	08-Oct-84	GROUND	GROUND	AP		8.199	10.952	
1328	08-Oct-84	GROUND	GROUND	AP	DA	7.722	10.135	RT VALVE W/SL SCRAPE
1329	08-Oct-84	GROUND	GROUND	AP		7.910	10.213	
1330	08-Oct-84	GROUND	GROUND	AP		7.168	9.276	
1331	08-Oct-84	GROUND	GROUND	AP		6.180	8.103	
1332	08-Oct-84	GROUND	GROUND	AP		3.546	4.336	
1333	08-Oct-84	GROUND	GROUND	AP		6.203	8.227	
1334	08-Oct-84	GROUND	GROUND	QP		5.969	6.718	
1335	08-Oct-84	GROUND	GROUND	QP		5.903	6.388	
1336	08-Oct-84	GROUND	GROUND	QP		5.522	5.982	
1337	08-Oct-84	GROUND	GROUND	AP		5.842	7.272	
1338	08-Oct-84	GROUND	GROUND	QP		5.547	6.187	
1339	08-Oct-84	GROUND	GROUND	QP		5.479	6.193	
1340	08-Oct-84	GROUND	GROUND	QP		5.613	5.949	
1341	08-Oct-84	GROUND	GROUND	QR		3.708	4.516	
1342	08-Oct-84	GROUND	GROUND	QQ		5.933	7.000	
1343	08-Oct-84	GROUND	GROUND	QQ		5.469	6.358	
1344	08-Oct-84	GROUND	GROUND	QQ		4.427	4.971	
1345	08-Oct-84	GROUND	GROUND	QN		5.273	5.956	
1346	08-Oct-84	GROUND	GROUND	PL		7.305	10.279	
1347	08-Oct-84	GROUND	GROUND	LF		3.965	5.949	
1348	08-Oct-84	GROUND	GROUND	PA		9.561	11.811	
1349	08-Oct-84	GROUND	GROUND	PA		10.419	13.274	
1350	08-Oct-84	GROUND	GROUND	LC		8.440	9.751	
1351	08-Oct-84	GROUND	GROUND	QQ		6.467	7.457	
1352	08-Oct-84	GROUND	GROUND	QQ		6.104	7.066	
1353	08-Oct-84	GROUND	GROUND	QQ		6.596	8.136	
1354	08-Oct-84	GROUND	GROUND	QQ		6.695	7.600	
1355	08-Oct-84	GROUND	GROUND	QQ		5.776	6.721	
1356	08-Oct-84	GROUND	GROUND	QQ		2.921	3.388	
1357	08-Oct-84	GROUND	GROUND	AP		8.682	11.638	
1358	08-Oct-84	GROUND	GROUND	AP	DA	8.283	11.595	RT BEAK W/VERY LARGE CHIP
1359	08-Oct-84	GROUND	GROUND	AP		7.991	11.146	
1360	08-Oct-84	GROUND	GROUND	AP		8.044	11.488	
1361	08-Oct-84	GROUND	GROUND	AP		8.377	11.407	
1362	08-Oct-84	GROUND	GROUND	AP		7.160	9.784	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1363	08-Oct-84	GROUND	GROUND	AP		7.389	9.799	BEAKS ERODED
1364	08-Oct-84	GROUND	GROUND	AP	DA	7.546	9.985	LFT VALVE W/SEV SCRAPE
1365	08-Oct-84	GROUND	GROUND	AP		5.786	11.125	UMBOS ERODED
1366	08-Oct-84	GROUND	GROUND	AP		7.607	11.034	
1367	08-Oct-84	GROUND	GROUND	AP		7.808	10.417	
1368	08-Oct-84	GROUND	GROUND	AP		7.483	10.130	
1369	08-Oct-84	GROUND	GROUND	AP		8.979	11.979	
1370	08-Oct-84	GROUND	GROUND	AP		8.809	11.847	
1371	08-Oct-84	GROUND	GROUND	QP		5.436	6.022	
1372	08-Oct-84	GROUND	GROUND	QP		5.522	6.167	
1373	08-Oct-84	GROUND	GROUND	QP		6.167	6.505	
1374	08-Oct-84	GROUND	GROUND	QP		5.453	5.779	
1375	08-Oct-84	GROUND	GROUND	AP		4.737	5.822	
1376	08-Oct-84	GROUND	GROUND	AF		3.200	3.909	
1377	08-Oct-84	GROUND	GROUND	OR		3.467	4.445	
1378	08-Oct-84	GROUND	GROUND	QN		5.682	6.335	
1379	08-Oct-84	GROUND	GROUND	QN		3.475	3.937	
1380	08-Oct-84	GROUND	GROUND	LF		7.412	11.189	
1381	08-Oct-84	GROUND	GROUND	PL		6.988	8.837	
1382	08-Oct-84	GROUND	GROUND	PL		7.315	9.766	
1383	08-Oct-84	GROUND	GROUND	PL		6.675	9.169	
1384	08-Oct-84	GROUND	GROUND	PL		6.281	7.897	
1385	08-Oct-84	GROUND	GROUND	PL		5.484	6.551	
1386	08-Oct-84	GROUND	GROUND	LF		6.690	11.036	
1387	08-Oct-84	GROUND	GROUND	PL		6.134	8.230	
1388	08-Oct-84	GROUND	GROUND	QQ		6.330	7.673	
1389	08-Oct-84	GROUND	GROUND	QQ		6.322	7.468	
1390	08-Oct-84	GROUND	GROUND	QP		6.175	6.805	
1391	08-Oct-84	GROUND	GROUND	QP		5.906	5.812	
1392	08-Oct-84	GROUND	GROUND	QP		5.799	6.289	
1393	08-Oct-84	GROUND	GROUND	QQ		5.845	7.051	
1394	08-Oct-84	GROUND	GROUND	OR		3.327	4.206	
1395	08-Oct-84	GROUND	GROUND	OR		2.784	3.470	
1396	08-Oct-84	GROUND	GROUND	QQ		5.240	6.279	
1397	08-Oct-84	GROUND	GROUND	QN		3.896	4.450	
1398	08-Oct-84	GROUND	GROUND	QQ		3.635	4.323	
1399	08-Oct-84	GROUND	GROUND	AP		8.275	10.373	
1400	08-Oct-84	GROUND	GROUND	AP		7.910	10.704	
1401	08-Oct-84	GROUND	GROUND	AP		8.212	11.245	
1402	08-Oct-84	GROUND	GROUND	AP	DA	8.075	11.097	RT VALVE W/SL CHIP
1403	08-Oct-84	GROUND	GROUND	AP	DA	7.932	10.335	RT VAL W/MOD SCRAPE;LFT VALVE W/SL CHIPS
1404	08-Oct-84	GROUND	GROUND	AP	DA	8.181	11.209	BOTH VALVES CHIPPED
1405	08-Oct-84	GROUND	GROUND	AP		7.678	10.424	
1406	08-Oct-84	GROUND	GROUND	AP	DA	7.523	9.629	LFT VALVE W/MOD SCRAPE
1407	08-Oct-84	GROUND	GROUND	AP		7.877	10.904	
1408	08-Oct-84	GROUND	GROUND	AP	DA	7.633	10.480	LFT VALVE W/SL SCRAPE
1409	08-Oct-84	GROUND	GROUND	AP		8.590	11.664	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1410	08-Oct-84	GROUND	GROUND	AP			8.235	11.079	
1411	08-Oct-84	GROUND	GROUND	AP			7.115	9.408	
1412	08-Oct-84	GROUND	GROUND	AP			7.656	10.079	
1413	08-Oct-84	GROUND	GROUND	AP			8.341	10.602	
1414	08-Oct-84	GROUND	GROUND	AP			7.851	10.833	
1415	08-Oct-84	GROUND	GROUND	AP			7.607	10.732	
1416	08-Oct-84	GROUND	GROUND	AP			8.219	11.252	
1417	08-Oct-84	GROUND	GROUND	AP			9.195	11.938	UMBOS ERODED
1418	08-Oct-84	GROUND	GROUND	AP		DA	7.887	11.171	LFT VALVE W/SL SCRAPE
1419	08-Oct-84	GROUND	GROUND	AP			7.861	10.681	
1420	08-Oct-84	GROUND	GROUND	AP			6.810	9.060	
1421	08-Oct-84	GROUND	GROUND	AP			7.381	10.358	
1422	08-Oct-84	GROUND	GROUND	AP		DA	7.625	10.030	RT VALVE W/SL SCRAPE
1423	08-Oct-84	GROUND	GROUND	AP			7.379	9.792	
1424	08-Oct-84	GROUND	GROUND	AP			7.216	9.312	
1425	08-Oct-84	GROUND	GROUND	AP			5.685	7.396	
1426	08-Oct-84	GROUND	GROUND	AP			6.142	7.714	
1427	08-Oct-84	GROUND	GROUND	AP			5.740	7.308	
1428	08-Oct-84	GROUND	GROUND	AP			5.321	6.375	
1429	08-Oct-84	GROUND	GROUND	AP			4.049	5.227	
1430	08-Oct-84	GROUND	GROUND	AP			3.541	4.544	
1431	08-Oct-84	GROUND	GROUND	AP		DA	3.305	4.003	LFT BEAK W/SL SCRAPE
1432	08-Oct-84	GROUND	GROUND	LF			6.792	9.545	
1433	08-Oct-84	GROUND	GROUND	LF			6.073	8.776	
1434	08-Oct-84	GROUND	GROUND	LF			6.246	8.750	
1435	08-Oct-84	GROUND	GROUND	LF			4.831	6.797	
1436	08-Oct-84	GROUND	GROUND	LF			2.898	4.267	
1437	08-Oct-84	GROUND	GROUND	PL			2.794	3.482	
1438	08-Oct-84	GROUND	GROUND	PL			5.578	6.721	
1439	08-Oct-84	GROUND	GROUND	PL			6.716	8.931	
1440	08-Oct-84	GROUND	GROUND	PL			5.055	6.436	
1441	08-Oct-84	GROUND	GROUND	PA			9.627	13.698	
1442	08-Oct-84	GROUND	GROUND	PA			9.510	13.307	
1443	08-Oct-84	GROUND	GROUND	PA			8.534	11.024	
1444	08-Oct-84	GROUND	GROUND	MG			11.725	17.005	
1445	08-Oct-84	GROUND	GROUND	AP		DA	7.221	9.868	LFT VALVE W/MOD SCRAPE
1446	08-Oct-84	GROUND	GROUND	AP		DA	8.105	10.386	LFT VALVE W/MOD SCRAPE
1447	08-Oct-84	GROUND	GROUND	AP			7.330	10.137	
1448	08-Oct-84	GROUND	GROUND	AP			7.445	10.490	
1449	08-Oct-84	GROUND	GROUND	AP			7.430	10.013	
1450	08-Oct-84	GROUND	GROUND	AP			7.089	9.642	
1451	08-Oct-84	GROUND	GROUND	AP			6.162	8.270	
1452	08-Oct-84	GROUND	GROUND	QQ			4.580	5.385	
1453	08-Oct-84	GROUND	GROUND	QQ			5.184	5.898	
1454	08-Oct-84	GROUND	GROUND	QQ			5.745	6.726	
1455	08-Oct-84	GROUND	GROUND	QR			3.327	4.262	
1456	08-Oct-84	GROUND	GROUND	QP			5.535	5.956	

Appendix C continued.

ID NUMBER	DATE	FROM PLOT	PLACED IN PLOT	SPEC. CODE	DEAD DAM	HEIGHT (CM)	LENGTH (CM)	COMMENTS
1457	08-Oct-84	GROUND	GROUND	QP		3.975	4.115	
1458	09-Oct-84	PILING	PILING	PA		9.495	11.638	
1459	09-Oct-84	PILING	PILING	LF		7.798	12.200	
1460	09-Oct-84	PILING	PILING	PL		6.797	9.535	
1461	09-Oct-84	PILING	PILING	LT		4.135	9.449	
1462	09-Oct-84	PILING	PILING	LT	DA	4.856	8.717	VALVES CHIPPED ON VENTRAL SURFACE
1463	09-Oct-84	PILING	PILING	LT		6.251	9.670	
1464	09-Oct-84	PILING	PILING	LT		5.659	9.060	
1465	09-Oct-84	PILING	PILING	LT		6.007	10.084	
1466	09-Oct-84	PILING	PILING	LT		5.814	9.169	
1467	09-Oct-84	PILING	PILING	LT		4.945	8.296	
1468	09-Oct-84	PILING	PILING	LT	DA	6.558	9.611	VALVES BROKEN ON POSTERIOR SURFACE
1469	09-Oct-84	PILING	PILING	LT		5.479	7.874	
1470	09-Oct-84	PILING	PILING	PL		5.065	6.617	
1471	09-Oct-84	PILING	PILING	PL		5.812	8.453	
1472	09-Oct-84	PILING	PILING	PL		6.091	7.887	
1473	09-Oct-84	PILING	PILING	PL		6.030	8.763	
1474	09-Oct-84	PILING	PILING	PL		5.405	7.940	
1475	09-Oct-84	PILING	PILING	PA		7.173	8.885	
1476	09-Oct-84	PILING	PILING	PA		7.671	9.296	
1477	09-Oct-84	PILING	PILING	PA		5.987	7.602	
1478	09-Oct-84	PILING	PILING	PA		7.645	9.528	BOTH VALVES W/OLD DENTS
1479	09-Oct-84	PILING	PILING	PA		7.483	10.516	
1480	09-Oct-84	PILING	PILING	PA		8.725	11.577	
1481	09-Oct-84	PILING	PILING	LC		7.252	8.141	
1482	09-Oct-84	PILING	PILING	PA		9.459	12.047	
1483	09-Oct-84	PILING	PILING	PA		9.769	13.106	
1484	09-Oct-84	PILING	PILING	PA		8.407	11.186	
1485	09-Oct-84	PILING	PILING	PA		10.206	12.802	
1486	09-Oct-84	PILING	PILING	PA		7.539	8.611	
1487	09-Oct-84	PILING	PILING	PL		7.424	9.644	
1488	09-Oct-84	PILING	PILING	PL		5.588	7.650	
1489	09-Oct-84	PILING	PILING	PL		6.223	8.326	
1490	09-Oct-84	PILING	PILING	PL		2.875	3.899	

Appendix D. Data for marked mussels recaptured in 1984 at the Illinois River study site, Naples, IL.

ID NUMBER	DATE RECAPTURED	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	REPLACED IN PLOT	COMMENTS
1	06-Oct-84			7.546	11.364	GROUNDED	
27	09-Oct-84			6.772	10.952	PILINGS	
30	09-Oct-84			6.642	10.709	PILINGS	
33	09-Oct-84			4.978	5.502	PILINGS	
38	09-Oct-84	DE		6.345	8.433	COLLECTED	
41	09-Oct-84		DA	6.726	9.182	PILINGS	LF VALVE-SL SCRAPE, WING CHIPPED
42	09-Oct-84			6.149	9.436	COLLECTED	
53	09-Oct-84	DE	DA	5.690	9.047	COLLECTED	RT VALVE-SMASHED
54	09-Oct-84			5.865	8.184	PILINGS	
55	09-Oct-84			7.381	14.892	PILINGS	
56	09-Oct-84			7.427	11.054	PILINGS	
62	09-Oct-84			6.081	9.398	PILINGS	
65	06-Oct-84			7.973	11.227	GROUNDED	
76	06-Oct-84			7.155	9.589	GROUNDED	
84	05-Oct-84		DA	7.277	10.071	GROUNDED	1 VALVE-SEVERE SCRAPE,2 RIDGES REMOVED
95	08-Oct-84			7.544	10.376	GROUNDED	
101	05-Oct-84			5.542	6.050	GROUNDED	
111	09-Oct-84			8.468	10.973	PILINGS	
112	09-Oct-84			7.620	10.528	PILINGS	
113	09-Oct-84			7.137	10.099	PILINGS	
114	09-Oct-84			6.947	9.550	PILINGS	
116	09-Oct-84		DA	7.328	10.058	PILINGS	BOTH VALVES-SL SCRAPES
117	09-Oct-84			6.947	9.373	PILINGS	
118	09-Oct-84			6.294	8.123	PILINGS	
119	09-Oct-84	DE		7.823	10.617	COLLECTED	
120	09-Oct-84			7.023	9.342	COLLECTED	
121	09-Oct-84			5.786	7.803	COLLECTED	
123	09-Oct-84	DE	DA	6.990	8.827	PILINGS	VALVES-SL SCRAPES
124	09-Oct-84			5.804	6.287	PILINGS	
125	09-Oct-84	DE		5.588	6.157	COLLECTED	
126	09-Oct-84			7.932	10.698	PILINGS	
128	09-Oct-84			7.958	10.551	PILINGS	
129	09-Oct-84			7.640	10.259	PILINGS	
130	09-Oct-84	DE				COLLECTED	
131	09-Oct-84			5.994	7.770	PILINGS	
132	09-Oct-84			7.544	10.325	PILINGS	
133	09-Oct-84	DE		6.906	9.114	COLLECTED	
135	09-Oct-84			12.103	17.371	PILINGS	
137	09-Oct-84			4.973	5.405	PILINGS	
140	09-Oct-84		DA	7.252	10.533	PILINGS	LF VALVE-CHIPPED
141	09-Oct-84	DE	DA	7.417	9.751	COLLECTED	BOTH VALVES-SL SCRAPES ON RIDGES
142	09-Oct-84	DE		7.971	10.472	COLLECTED	
143	09-Oct-84			6.543	9.174	PILINGS	
147	09-Oct-84		DA	7.747	10.480	PILINGS	BOTH VALVES-SL SCRAPE
149	09-Oct-84		DA	5.720	6.795	PILINGS	RT VALVE-SCRAPED
151	09-Oct-84			5.151	5.674	PILINGS	
153	09-Oct-84	DE		7.328	9.743	COLLECTED	

Appendix D continued.

ID NUMBER	DATE RECAPTURED	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	REPLACED IN PLOT	COMMENTS
156	09-Oct-84			4.229	4.516	PILINGS	
157	09-Oct-84	DE		5.624	5.687	COLLECTED	
159	09-Oct-84			6.213	7.242	PILINGS	
160	09-Oct-84			3.515	4.478	PILINGS	
161	09-Oct-84			7.831	11.062	PILINGS	
162	09-Oct-84			5.867	7.564	PILINGS	
163	09-Oct-84			8.301	11.346	PILINGS	
164	09-Oct-84			7.747	10.927	PILINGS	
166	09-Oct-84			7.569	10.277	PILINGS	
167	09-Oct-84			7.313	10.015	PILINGS	
168	09-Oct-84			8.072	11.379	PILINGS	
169	09-Oct-84			8.225	10.541	PILINGS	BEAKS-ERRODED
170	09-Oct-84			7.836	10.013	PILINGS	
171	09-Oct-84			7.701	9.995	PILINGS	
172	09-Oct-84			8.484	10.965	PILINGS	
173	09-Oct-84		DA	8.725	11.570	PILINGS	BOTH VALVES-SL CHIPS
175	09-Oct-84			7.196	9.596	PILINGS	
176	09-Oct-84		DA	7.925	11.460	PILINGS	RT BEAK-CHIPPED
178	09-Oct-84			7.625	10.028	PILINGS	
179	09-Oct-84		DA	5.720	6.007	PILINGS	RT VALVE-SCRAPE
180	09-Oct-84		DA	7.760	11.737	PILINGS	BEAK-PUNCTURED
181	07-Oct-84			6.734	8.964	DOWNSTREAM	
182	07-Oct-84			6.947	9.263	DOWNSTREAM	
183	07-Oct-84			6.561	8.710	DOWNSTREAM	
184	07-Oct-84			6.914	8.877	DOWNSTREAM	
185	07-Oct-84	DE		6.861	8.954	COLLECTED	
186	07-Oct-84			6.543	8.473	DOWNSTREAM	
187	07-Oct-84			7.285	9.261	DOWNSTREAM	
188	07-Oct-84			5.400	7.201	DOWNSTREAM	
189	07-Oct-84			5.771	7.681	DOWNSTREAM	
190	07-Oct-84			10.854	14.288	DOWNSTREAM	
191	07-Oct-84			4.907	7.722	DOWNSTREAM	
193	07-Oct-84		DA	8.021	12.367	DOWNSTREAM	HINGE-BROKEN
194	07-Oct-84			6.177	8.067	DOWNSTREAM	
195	07-Oct-84			8.458	12.149	DOWNSTREAM	
196	07-Oct-84		DA	7.699	10.389	DOWNSTREAM	LF VALVE-SL SCRAPE
197	07-Oct-84			7.303	10.030	DOWNSTREAM	
198	07-Oct-84		DA	7.346	9.106	DOWNSTREAM	RT VALVE-VERY SL SCRAPE
199	07-Oct-84			6.701	9.296	DOWNSTREAM	
200	07-Oct-84			5.999	7.854	DOWNSTREAM	
201	07-Oct-84			7.137	9.774	DOWNSTREAM	
202	07-Oct-84			5.583	5.806	DOWNSTREAM	
203	07-Oct-84			5.718	6.073	DOWNSTREAM	
204	07-Oct-84			7.376	9.799	DOWNSTREAM	
205	07-Oct-84			6.314	8.072	DOWNSTREAM	
206	07-Oct-84		DA	7.983	10.935	DOWNSTREAM	LF VALVE-SL SCRAPES ON 4 RIDGES
208	07-Oct-84			7.783	10.617	DOWNSTREAM	

Appendix D continued.

ID NUMBER	DATE RECAPTURED	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	REPLACED IN PLOT	COMMENTS
209	07-Oct-84			7.026	9.192	DOWNSTREAM	
210	07-Oct-84			7.501	9.477	DOWNSTREAM	
211	07-Oct-84			7.587	10.376	DOWNSTREAM	
212	07-Oct-84			5.542	6.408	DOWNSTREAM	
213	07-Oct-84			7.912	10.958	DOWNSTREAM	
214	07-Oct-84			7.239	10.140	DOWNSTREAM	
215	07-Oct-84			7.087	9.652	DOWNSTREAM	
216	07-Oct-84			6.835	9.500	DOWNSTREAM	
217	07-Oct-84			8.402	10.866	DOWNSTREAM	
218	07-Oct-84			5.880	7.902	DOWNSTREAM	
219	07-Oct-84			8.014	10.780	DOWNSTREAM	
220	07-Oct-84			8.379	11.750	DOWNSTREAM	
225	07-Oct-84			4.521	4.653	DOWNSTREAM	
226	07-Oct-84			4.648	4.973	DOWNSTREAM	
229	07-Oct-84		DA	9.538	11.674	DOWNSTREAM	BOTH VALVES-SL SCRAPE ON RIDGES (OLD)
234	07-Oct-84			7.803	11.201	DOWNSTREAM	
235	07-Oct-84			7.386	9.347	DOWNSTREAM	
236	07-Oct-84			7.239	9.121	DOWNSTREAM	
292	05-Oct-84			8.341	11.176	GROUNDED	
293	05-Oct-84			7.615	9.870	GROUNDED	
327	05-Oct-84			8.052	11.331	GROUNDED	
343	07-Oct-84			7.557	10.607	DOWNSTREAM	
347	07-Oct-84			5.646	8.390	DOWNSTREAM	
348	07-Oct-84	DE		5.100	8.189	COLLECTED	
354	07-Oct-84			7.562	11.100	DOWNSTREAM	
356	07-Oct-84			7.356	10.124	DOWNSTREAM	
365	07-Oct-84			4.793	7.275	DOWNSTREAM	BOTH VALVES-SLIGHT DENTS (OLD)
384	07-Oct-84			4.559	6.660	DOWNSTREAM	
385	07-Oct-84			5.075	7.521	DOWNSTREAM	
389	07-Oct-84			5.791	8.636	DOWNSTREAM	
390	07-Oct-84			6.901	9.157	DOWNSTREAM	
391	07-Oct-84			6.668	9.144	DOWNSTREAM	
392	07-Oct-84	DE		7.521	9.921	COLLECTED	
393	07-Oct-84			6.817	9.268	DOWNSTREAM	
394	07-Oct-84			6.713	8.423	DOWNSTREAM	
395	07-Oct-84			6.609	9.182	DOWNSTREAM	
399	07-Oct-84	DE	DA	5.403	7.325	COLLECTED	WING-BROKEN OFF
400	07-Oct-84			6.119	8.230	DOWNSTREAM	
404	07-Oct-84			4.674	10.917	DOWNSTREAM	
430	06-Oct-84			6.568	8.258	UPSTREAM	
432	06-Oct-84			6.350	8.128	UPSTREAM	
435	06-Oct-84			6.518	8.489	UPSTREAM	
441	06-Oct-84			6.327	8.064	UPSTREAM	
458	08-Oct-84		DA	6.772	8.225	GROUNDED	LF VALVE-SLIGHT SCRAPE
461	04-Oct-84			5.682	7.717	GROUNDED	
464	05-Oct-84			5.972	7.623	GROUNDED	
467	04-Oct-84		DA	7.915	10.622	GROUNDED	RIDGES-SCRAPPED

Appendix D continued.

ID NUMBER	DATE RECAPTURED	DEAD	DAM	HEIGHT (CM)	LENGTH (CM)	REPLACED IN PLOT	COMMENTS
469	04-Oct-84			8.141	10.681	GROUNDED	
470	04-Oct-84			8.385	10.798	GROUNDED	
471	04-Oct-84			7.879	10.508	GROUNDED	
477	04-Oct-84		DA	7.922	10.886	GROUNDED	BOTH VALVES-SL SCRAPES
478	04-Oct-84			7.320	9.573	GROUNDED	
479	04-Oct-84	DE		7.275	9.611	COLLECTED	
481	04-Oct-84			8.562	11.006	GROUNDED	
486	05-Oct-84			5.880	6.520	GROUNDED	
494	04-Oct-84			8.941	12.037	GROUNDED	
495	04-Oct-84		DA	7.564	10.493	GROUNDED	DORSAL-CHIPPED
511	05-Oct-84			8.171	11.077	GROUNDED	
581	06-Oct-84	DE		4.826	6.581	COLLECTED	
622	05-Oct-84			11.318	13.726	GROUNDED	
650	05-Oct-84			9.276	12.766	GROUNDED	
656	08-Oct-84			7.681	10.201	GROUNDED	
657	05-Oct-84		DA	8.585	11.184	GROUNDED	BOTH VALVES-SL SCRAPES,CHIPS
671	08-Oct-84		DA	8.412	11.392	GROUNDED	LF VALVE-SCRAPED MODERATELY
673	04-Oct-84	DE		8.227	10.594	COLLECTED	RECAP ON SHORE
675	08-Oct-84			6.675	9.286	GROUNDED	
678	04-Oct-84			8.072	10.556	GROUNDED	RECAP ON SHORE
680	04-Oct-84			7.132	9.497	GROUNDED	RECAP ON SHORE
681	05-Oct-84			7.145	9.741	GROUNDED	
682	05-Oct-84			8.131	10.376	GROUNDED	
683	04-Oct-84			7.506	10.173	GROUNDED	RECAP ON SHORE
691	05-Oct-84		DA	7.414	9.906	GROUNDED	VALVE- SL SCRAPE ON RIDGES
696	08-Oct-84			5.583	6.073	GROUNDED	
700	04-Oct-84	DE		6.363	6.970	COLLECTED	RECAP ON SHORE
707	05-Oct-84			8.677	11.046	GROUNDED	
711	05-Oct-84		DA	7.610	10.381	GROUNDED	VALVE-SL SCRAPE-2 RIDGES
716	05-Oct-84			6.416	8.733	GROUNDED	
717	05-Oct-84			7.684	9.802	GROUNDED	
721	05-Oct-84		DA	7.440	10.084	GROUNDED	BEAKS-CHIPPED VALVE-CHIPS 2 RIDGES
726	08-Oct-84			7.620	10.099	GROUNDED	
734	05-Oct-84			7.470	10.429	GROUNDED	
735	05-Oct-84			8.143	11.232	GROUNDED	
742	08-Oct-84			6.731	7.186	GROUNDED	
745	05-Oct-84			4.488	5.428	GROUNDED	

Appendix E. Report on emergency sampling to verify reports of a mussel die-off in the Upper Mississippi River.

In September 1982, fishery biologists attending the meeting of the Fish Technical Section of the Upper Mississippi Conservation Committee reported seeing an unusually large number of mussel "meats" (the soft interior tissue of the mussels) floating in the Mississippi River in July from Rock Island, Illinois, to as far north as LaCrosse, Wisconsin (UMRCC 1983).

In spring 1983, commercial clammers who used diving gear reported large numbers of freshly dead shells in formerly productive beds. Mr. Arnold ("Bill") Fritz, commercial fishery biologist for the Illinois Department of Conservation, asked us to investigate and quantify the mortality in two beds in Pools 14 and 15 near Rock Island.

We sampled a total area of 8 m^2 in Pool 14, 100 m from the Illinois shore (river mile 494.7) and 4 m^2 in Pool 15, 150 m upstream of Arsenal Island at the entrance to Sylvan Slough, approximately 50 m from the Illinois shore (river mile 486.0). We used 0.5-m^2 steel sampling frames and the surface supply diving gear we described previously.

Recently dead mussels met the following criteria:

1. periostracum (horny brown/black layer covering the outside of the shell) retained,
2. valves firmly joined at the hinge,
3. interior nacre shiny, not chalky,

Appendix E continued.

Results from both pools verified the commercial clammers' reports (Table E1): 35-42% of the commercially valuable Amblema plicata (three-ridge) and Megalonaias gigantea (washboards) had died recently. Mortality in other species for which we had adequate sample sizes (30 or more individuals) ranged from a low of 9.8% for Leptodea fragilis (fragile papershell) to a high of 37.6% for Quadrula pustulosa (pimpleback). Ms. Pamela Thiel, Wisconsin Department of Natural Resources, conducted emergency sampling in Pool 10 and found 20-40% of the mussels had died recently (UMRCC 1983).

We submitted samples of living but moribund individuals to Fritz and to Richard Ruelle, Ecological Services Office, U. S. Fish and Wildlife Service, Rock Island, Illinois. They in turn submitted them to several laboratories for contaminant analyses. According to both men, the lab results indicated no unusually high concentrations of heavy metals or organic contaminants, although background levels for freshwater mussels have not been determined. Another possible cause for the die-off could be biological--an outbreak of parasites or disease.

Dr. John Nickum, Iowa Cooperative Fisheries Unit, Iowa State University, is compiling information about the 1982-1983 mussel die-off for the Upper Mississippi River Conservation Committee, and a copy of Table E1 was mailed to him on 8 March 1984.

In July 1985, another massive die-off of mussels appeared to be in progress. Biologists were reporting meats floating in the Mississippi River, and divers were finding shells with decayed meats inside and live mussels which were gaping and too weak to

Table E1. Live and recently dead mussels from pools 14 and 15, Upper Mississippi River, Rock Island County, Illinois, 27-30 June 1983

	Pool 14 ($8m^2$ sampled)				Pool 15 ($4m^2$ sampled)			
	Live	Recently dead	Total	Percent recently dead	Live	Recently dead	Total	Percent recently dead
Cumberlandia monodonta	0	0	0	0.0	1	0	1	0.0
Fusconaia ebena	0	2	2	100.0	0	0	0	0.0
Fusconaia flava	0	1	1	100.0	5	2	7	28.6
Megalonaias gigantea	61	37	98	37.8	35	25	60	41.7
Amblema plicata	21	13	34	38.2	41	22	63	34.9
Quadrula quadrula	14	3	17	17.6	11	2	13	15.4
Quadrula pustulosa	4	13	17	76.5	83	50	133	37.6
Quadrula nodulata	1	1	2	50.0	0	2	2	100.0
Quadrula metanevra	0	0	0	0.0	8	3	11	27.3
Elliptio dilatatus	0	0	0	0.0	0	1	1	100.0
Arcidens confragosus	0	0	0	0.0	1	0	1	0.0
Anodonta grandis	1	1	2	50.0	5	0	5	0.0
Anodonta imbecillis	3	1	4	25.0	12	1	13	7.7
Obliquaria reflexa	1	2	3	66.7	15	7	22	31.8
Plagiola lineolata	0	2	2	100.0	29	6	35	17.1
Truncilla truncata	1	4	5	80.0	40	20	60	33.3
Truncilla donaciformis	0	2	2	100.0	13	5	18	27.8
Leptodea fragilis	9	4	13	30.8	37	4	41	9.8
Proptera alata	3	0	3	0.0	16	2	18	11.1
Ligumia recta	0	0	0	0.0	3	0	3	0.0
Lampsillis ventricosa	2	0	2	0.0	5	1	6	16.7
Total	121	86	207	41.5	360	153	513	29.7

resist a mildly forceful attempt by hand to open their shells. The State Fish Pathologist of the Illinois Department of Conservation, Mr. Rod Horner, examined some of these moribund individuals and reported that cilia on the gills were still beating and the animals appeared to be infected with Columnaris-type bacteria. He was unable to determine whether the bacteria caused the morbidity or simply invaded the mussels after they were weakened by some other primary cause.

The finest beds of mussels remaining in the Mississippi, including some rare and endangered species, lie within the area of the die-offs, and we believe a program to determine the cause should be concerted as soon as possible.