TU55 3-K5-PA
Intake Three Mile Is.

AN ECOLOGICAL STUDY OF THE SUSQUEHANNA RIVER IN THE VICINITY OF THE THREE MILE ISLAND NUCLEAR STATION

Annual Report For 1977

by

George A. Nardacci, Project Leader, and Associates
Ichthyological Associates, Inc.
P.O. Box 223, Etters, Pennsylvania 17319

for

METROPOLITAN EDISON COMPANY

ICHTHYOLOGICAL ASSOCIATES, INC.
Edward C. Raney, Ph.D., President
301 Forest Drive, Ithaca, New York 14850

April 1978

AmerGen SM
An Exelon Company

AmerGen Energy Company, LLC
Three Mile Island Unit 1
Route 441 South, P.O. Box 480
Middletown, PA 17057

Telephone: 717-948-8000

July 21, 2005
5532-2005-043

Mr. Kelly Meadows
Tetra Tech, Inc.
10306 Eaton Place, Suite 340
Fairfax, VA 22030

Dear Sir:

SUBJECT: IMPINGEMENT AND ENTRAINMENT MONITORING STUDY
NPDES PERMIT PA 0009920
THREE MILE ISLAND UNIT 1

Pursuant to our recent telephone conversation please find enclosed requested impingement and entrainment study information for Three Mile Island Nuclear Station. The following study information is enclosed for your review - An Ecological Study of the Susquehanna River in the Vicinity of the Three Mile Island Nuclear Station, Annual Report for 1977, prepared by Ichthyological Associates, Inc., April 1978. Section 4.0, Entrainment of Ichthyoplankton, and Section 5.0, Impingement of Fish. Please note that the attached 1977 impingement and entrainment study data were the most recent study information located in response to your request.

Should you require additional information or have questions concerning the attached impingement and entrainment data please contact me at (717) 948-8881 or e-mail at *scott.cogley@exeloncorp.com.*

Sincerely,

S. R. Cogley
Environmental Chemist

SRC

Attachments

TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION	1
1.1	SUMMARY	2
2.0	MACROINVERTEBRATES Janet L. Polk, John H. Epler, III	
2.1	Methods	13
2.1.1	Taxonomic Treatment	14
2.1.2	Data Analysis	18
2.2	Results	20
2.2.1	Density	21
2.2.2	Biomass	22
2.2.3	Diversity	22
2.2.4	Percent Similarity Composition	23
2.2.5	Statistical Analysis	23
2.3	Discussion	26
3.0	ICHTHYOPLANKTON Barbara F. Lathrop	
3.1	Methods	111
3.1.1	Taxonomy	116
3.2	Results	117
3.2.1	Data Analysis	118
3.2.2	Density	120
3.2.3	Diversity and Equitability Indices	123
3.2.4	Percentage Similarity	123
3.3	Discussion	123
4.0	ENTRAINMENT OF ICHTHYOPLANKTON Philip C. Ritson	
4.1	Materials and Methods	264
4.2	Results	268
4.3	Discussion	271
5.0	IMPINGEMENT OF FISH George A. Nardacci	
5.1	Methods	303
5.2	Results	304
5.3	Discussion	305
6.0	FISH	
6.1	Trapnet Robert W. Malick, Jr.	
6.1.1	Methods	322
6.1.2	Results	324
6.1.2.1	Mean Weight, Condition Factor, and Reproductive Status	325
6.1.2.2	Parasites	326
6.1.3	Discussion	327
6.2	Seine Robert W. Malick, Jr.	
6.2.1	Methods	328
6.2.2	Results	330
6.2.2.1	Mean Weight, Condition Factor, and Reproductive Status	332
6.2.2.2	Parasites	333
6.2.3	Discussion	334
6.3	Electrofishing Harold A. Hagerty	
6.3.1	Methods	335
6.3.2	Results	339
6.3.2.1	Condition Factor	340
6.3.2.2	Species Diversity	341
6.3.2.3	Catch Per Effort	341
6.3.2.4	Percentage Similarity	342
6.3.2.5	Kendall's Tau (T)	343
6.3.3	Discussion	344
7.0	POPULATION ESTIMATES OF FISHES Harold A. Hagerty	
7.1	Methods	448
7.2	Results and Discussion	450
8.0	CREEL SURVEYS Lynn D. Wike	
8.1	Methods	463
8.2	Results	465
8.3	Discussion	468

4.0 ENTRAINMENT OF ICHTHYOPLANKTON

The composition, distribution, and abundance of ichthyoplankton over time and depth were investigated in the TMINS Unit 1 Intake pump suction bay. Estimates of the total number of fish entrained for each 24-hour sample period and the percentage of fish in the center channel of York Haven Pond at night were calculated for each sample date. A comparison was made between 1976 and 1977 estimates.

4.1 MATERIALS AND METHODS

Replicate (2) samples were taken semimonthly March through August 1977. Surface and oblique samples were taken at 6-hour intervals (1000, 1600, 2200, 0400 h) over a 24-hour period with a 0.5 m plankton net (0.5 mm mesh) towed across the TMINS Unit 1 Intake pump suction bay (a distance of about 20 m) Figure 4.1-1. Oblique tows originated about 1.0 m from the bottom. The volume of the water filtered was measured by a General Oceanics digital flow meter (Model 2030) mounted in the mouth of the net. Numbers of fish caught were standardized by conversion to density (number per 100 cubic meters of water, n/100 m^3). Water temperature (C), dissolved oxygen (ppm), and pH were also taken. River stage (0700 h) was obtained from the River Forecast Center in Harrisburg, Pennsylvania.

Samples were preserved in a solution of 25% formalin, sorted, and stored in a 10% isopropanol and 20% formalin solution for later identification. Undamaged fish were measured (to the nearest 0.1 mm and grouped into 1.0 mm intervals total length, TL) and identified with the aid of reference materials by Armstrong (1962), Fish (1932), Gerlach (1973), Lippson

and Moran (1974), Mansueti (1964), Mansueti and Hardy (1967), May and Gasaway (1967), Meyer (1970), Nelson (1968), Norden (1961), Siefert (1969), and Stewart (1926). In cases where several species of a genus or genera of a family were present, fish with indistinguishable taxonomic characters were assigned to slash (either/or) categories rather than to the less descriptive genus or family classification. Only fish less than or equal to 25.0 mm were considered as ichthyoplankton.

A list of the ichthyoplankton collected is presented in Table 4.1-1. Scientific and common names and taxonomic order of presentation followed Bailey et al. (1970).

Developmental terminology was defined by Snyder (1976). Larval stages were characterized by the presence of the finfold and lack of adult ray counts in all fins. The larval stage was further subdivided into protolarva, mesolarva, and metalarva. Protolarvae were characterized by the lack of formed rays in the fins and finfold and included the yolk sac stage. Mesolarvae were characterized by the development of rays in the finfold (usually caudal), development of the median fins, and absence of pelvic fins. The metalarval stage was characterized by the presence of pelvic fin buds and continued development of the other fins. The term young was applied to those stages of fish characterized by the complete absorption of the finfold and the presence of adult ray counts in all fins.

A three factor analysis of variance (ANOVA) was performed to test for differences between sample dates, times, and depths (Sokal and Rohlf 1969). Analysis was performed on untransformed densities (n/3 m^3) of total ichthyoplankton. Individual taxa were present in too low

numbers to warrant analysis. A density of n/3 m^3 was used in preference to n/100 m^3 because it more closely approximated the sample size.

The Student-Newman-Kuels multirange test (SNK) was used to determine which sample means were significantly different after an initial difference was recognized by ANOVA (Woolf 1968).

An index of percent similarity was computed to identify likenesses between depths and times with respect to composition of fishes (Whittaker and Fairbanks 1958). It was expressed as:

$$PSc = \sum \min (a,b)$$

where PSc = the percent similarity, and a and b = the percentages of species a and b in samples A and B. PSc values range from 0 (no similarity) to 100 (complete similarity). This is an empirical index and measures relative similarity in terms of species composition and generally leads to the grouping of communities by dominant or major species.

The center channel of York Haven Pond at Transect TM-LF-13A3 was subdivided into four zones (Table 4.1-2 and Figure 4.1-2). The mean density of ichthyoplankton in each zone was estimated from data obtained from stations 13A1 and 13A2 of the far-field ichthyoplankton program (Section 3.0) and the estimated density of fish in the midchannel. All ichthyoplankton were assumed to be drifting with the river flow. Density in the midchannel was estimated from the regression equation:

$$Y = .23x + 5.05$$

where Y = the density of ichthyoplankton in the midchannel and x = the density of ichthyoplankton at Station 13A2. This equation was generated

from ichthyoplankton collections taken at midchannel and nearshore locations near the TMINS Unit 1 Intake in 1975 (Lathrop 1976).

The average intake flow rate (100 m^3/min) for 2200 and 0400 h was estimated from the formula:

$$Fi = \left(\sum_{p=1}^{a} Np\ 2200\ h + \sum_{p=1}^{a} Np\ 0400\ h \right)/2$$

where a = the total number of river water pumps in operation for each sample period and Np = the rated capacity of each river water pump.

The flow rate (100 m^3/min) for each zone was estimated from river flow data obtained from the River Forecast Center in Harrisburg, Pennsylvania and the cross section area of each zone computed from the river profile prepared by Gilbert Associates, Inc. (1975). The flow rate was calculated from the formula:

$$Fj = \left(Aj / \sum_{j=1}^{j} Aj\right) \left[Cw/(Cw + Ww)\right] \left[(F1 + F2)/2\right]$$

where Fj = the flow rate in zone j, Aj = the cross section area of zone j, Cw = the width of the center channel at Transect TM-LF-13A3, Ww = the width of the center channel at Transect TM-LF-13A3, F1 = the river flow at 0700 h at Harrisburg, Pennsylvania for the first day of each entrainment survey, and F2 = the river flow at 0700 h for the second day of each entrainment survey. The east channel was not included in this calculation as all flow through the east channel was blocked by Red Hill Dam.

The mean density (n/100 m^3) of ichthyoplankton in river zones 2 and 3 were calculated with the formulas:

$$N_{II} = (N_{13A2} + N_{mid})/2$$

$$N_{III} = (N_{13A1} + N_{mid})/2$$

where N_{II} = the mean density of ichthyoplankton in Zone 2, N_{III} = the mean density of ichthyoplankton in Zone 3, N_{13A2} = the density of ichthyoplankton at Station 13A2, N_{13A1} = the density of ichthyoplankton at Station 13A1, and N_{mid} = the estimated density of ichthyoplankton in the midchannel.

The mean density of ichthyoplankton in zones 1 and 4 was determined to be the density of ichthyoplankton at stations 13A2 and 13A1, respectively.

The percentage of ichthyoplankton in the center channel which were entrained at night on each sample date was estimated from the formula:

$$\% \text{ Entrained} = (NiFi/ \sum_{i=1}^{b} NjFi)\ 100$$

where Ni = the mean density (n/100 m^3) of ichthyoplankton taken in oblique tows at 2200 and 0400 h, Fi = the average intake flow rate (100 m^3/min) for 2200 and 0400 h, b = the number of zones, Nj = the mean density (n/100 m^3) of ichthyoplankton in zone j, and Fj = the flow rate (100 m^3/min) in zone j.

The 1976 estimate was recalculated due to an error in the original estimate and the updated estimate is presented herein.

4.2 RESULTS

A total of 585 larval (325 surface, 260 oblique) and 11 young (7 surface, 4 oblique) fish was taken in 192 collections. Data for

each sampling date are presented in Tables 4.2-1 through 4.2-12 and summarized in Tables 4.2-13 and 4.2-14. Length frequency data for the seven most numerous fishes are presented in Table 4.2-15.

Larvae were collected from 17 April through 11 August; young on 25-26 May, 16-17 June, and 25-26 July. Peak densities of total ichthyoplankton were recorded on 25-26 May, 29-30 June, and 25-26 July (Table 4.2-13). Densities of carp, comely shiner, spottail shiner, fallfish, quillback, white sucker, shorthead redhorse, banded darter, and shield darter were highest on 25-26 May (Table 4.2-13). High densities of pumpkinseed/bluegill and spotfin shiner occurred on 29-30 June and 25-26 July, respectively.

Cyprinids (minnows and carps) were collected from 12 May through 11 August. The spotfin shiner, spottail shiner, and carp were most common.

The spotfin shiner was most abundant on 29-30 June and 25-26 July. Fish 5.1 to 6.0 mm accounted for 72% of the spotfin shiners taken on these dates. Densities were generally higher near the surface.

The spottail shiner was taken from 12 May through 17 June; it was most abundant on 25-26 May. Ninety-three percent of the spottail shiners collected on 25-26 May ranged from 4.1 to 7.0 mm. Fish 11.1 to 19.0 mm comprised 100% of the spottail shiner taken on 16-17 June.

Catostomids (suckers), included the white sucker (65%), quillback (25%), and shorthead redhorse (10%), were taken from 27 April through 17 June.

The channel catfish was the only ictalurid taken; it was collected

on 16 June and 26 July.

Centrarchids (sunfishes) were collected from 25 May through 19 July and on 10-11 August; most were taken on 29-30 June. The pumpkinseed/bluegill was collected on 29-30 June. Those fish 5.1 to 7.0 7.0 mm were most abundant. Densities of pumpkinseed/bluegill were generally higher at the surface.

Percids (perches) were taken from 27 April through 29 June. Peak density was recorded on 25-26 May. The shield darter and banded darter were most abundant; tessellated darter and walleye were also taken.

Results of the ANOVA and SNK are presented in Tables 4.2-16 and 4.2-17. Significant differences ($P \leq 0.05$) were noted for sample date, depth, and time. Ichthyoplankton densities on 29-30 June and 25-26 May were significantly higher; densities on all other dates were not significantly different. Surface densities of ichthyoplankton were significantly higher than oblique densities. This was similar to that reported in 1976 (Ritson 1977). The 1000 and 0400 h sample periods had significantly higher densities as compared to the other 6-hour intervals; no day-night trend was observed. Interaction effects were noted between date and time.

Percent composition of fishes for time and depth is presented in Tables 4.2-18 and 4.2-19. Percent similarity indices for time and depth are presented in Table 4.2-20. A high degree of similarity between depths was found at 1000, 2200, and 0400 h (72.0, 70.1, 84.1) and a moderate degree at 1600 h (54.6). Values for percent similarity between times were generally higher between 1000, 2200, and 0400 h

(51.2 to 66.5) than between 1600 h and 1000, 2200, and 0400 h (27.8 to 50.5). A similar relationship for depth and time was reported in 1976 by Ritson (1977).

The distribution of ichthyoplankton across Transect TM-LF-13A3 is illustrated in Figure 4.2-1. The density of fish in 1977 was generally higher in Zone I with the exception of 9-10 August when density was greatest in Zone III. A density gradient from the west shore of Three Mile Island (Zone I) to the east shore of Shelley Island (Zone IV) was determined. Densities of fish in all zones were generally lower in 1977 than 1976. Estimates of the percentage of ichthyoplankton drifting through Transect TM-LF-13A3, which were entrained at night by TMINS Unit 1 in 1977, ranged from 0.3% on 27-28 April to 7.0% on 25-26 July (Table 4.2-21). Night estimates for 1976 ranged from 1.7% on 27-28 May to 13.6% on 11-12 May (Table 4.2-22).

Estimates of the number of ichthyoplankton entrained in 1977 in each 24-hour sample period ranged from 46,210 (n/24-h) on 27-28 April to 1,596,220 on 25-26 May (Table 4.2-23). Values for 1976 ranged from 101,450 on 11-12 August to 2,413,590 on 12-13 May. The total number of ichthyoplankton entrained on eight sample dates in 1976 was 7,085,350; 3,005,740 were entrained in 1977.

4.3 DISCUSSION

The estimates of the percentage of ichthyoplankton in the center channel of York Haven Pond which were entrained and the estimated number of ichthyoplankton entrained during each 24-h sample period were lower in 1977 than 1976. Densities of ichthyoplankton in zones I, II, III,

and IV were also lower in 1977 than 1976. Operation of TMINS, in particular, the intake flow rate, was similar in 1976 and 1977 (Tables 4.2-21 and 4.2-22). It appeared therefore that the decline in entrainment rates was probably the result of natural fluctuations in river ichthyoplankton densities and was not due to changes in the operation of TMINS.

LITERATURE CITED

Armstrong, P.B. 1962. Stages in the development of Ictalurus nebulosus. Syracuse Univ. Press. Syracuse, New York. 8 pp.

Bailey, R.M., J.E. Fitch, E.S. Herald, E.A. Lachner, C.C. Lindsey, C.R. Robins, and W.B. Scott. 1970. A list of common and scientific names of fishes from the United States and Canada. Amer. Fish. Soc. Special Publ. No. 6. 150 pp.

Fish, M.P. 1932. Contribution to the early life histories of sixty-two species of fishes from Lake Erie and its tributary waters. U.S. Bur. Fish. Bull. 47(10):293-398.

Gerlach, J.M. 1973. Early development of the quillback carpsucker, Carpiodes cyprinus. M.S. Thesis, Millersville State College. Millersville, Pennsylvania. 48 pp.

Gilbert Associates, Incorporated. 1975. Hydrographic survey Three Mile Island Nuclear Station June 1975. 22 pp.

Lathrop, B.F. 1976. Ichthyoplankton. Pages 7-35 In G.A. Nardacci, and W.A. Potter, et al. An ecological study of the Susquehanna River in the vicinity of the Three Mile Island Nuclear Station. Supplemental Report for 1975. Ichthyological Associates, Inc. 249 pp.

Lippson, A.J. and R.L. Moran. 1974. Manual for identification of early developmental stages of the Potomac River Estuary. Martin Marietta Corporation, Environmental Technology Center. Baltimore, Maryland. 282 pp.

Mansueti, A.J. 1964. Early development of the yellow perch, Perca flavescens. Ches. Sci. 5(1-2):46-66.

Mansueti, A.J. and J.D. Hardy, Jr. 1967. Development of fishes of the Chesapeake Bay region; an atlas of egg, larval, and juvenile stages. Natural Resources Institute. University of Maryland. 202 pp.

May, E.B. and C.R. Gasaway. 1967. A preliminary key to the identification of larval fishes of Oklahoma, with particular reference to Canton Reservoir, including a selected bibliography. Oklahoma Department of Wildlife Conservation Bull. No. 5. 42 pp.

Meyer, F.A. 1970. Development of some larval centrarchids. Prog. Fish-Cult. 32(3):130-136.

Nelson, W.R. 1968. Embryo and larval characteristics of sauger, walleye, and their reciprocal hybrids. Trans. Am. Fish. Soc. 97(2):167-174.

Norden, C.R. 1961. The identification of larval yellow perch, Perca flavescens and walleye, Stizostedion vitreum. Copeia 1961(3):282-288.

Ritson, P.C. 1977. Entrainment of Ichthyoplankton. Pages 147-181 In G.A. Nardacci, et al. An ecological study of the Susquehanna River in the vicinity of the Three Mile Island Nuclear Station. Supplemental Report for 1976. Ichthyological Associates, Inc. 413 pp.

Siefert, R.E. 1969. Characteristics for separation of white and black crappie larvae. Trans. Am. Fish. Soc. 98(2):326-328.

Snyder, D.E. 1976. Terminologies for intervals of larval fish development. pp. 41-60. In J. Borman, editor. Great Lakes Fish Egg and Larvae Identification: Proceedings of a Workshop. U.S. Fish and Wildlife Service. National Power Plant Team. Ann Arbor, Michigan.

Sokal, R.R. and F.J. Rohlf. 1969. Biometry, the principals and practice of statistics in biological research. W.H. Freeman, San Francisco. 776 pp.

Stewart, N.H. 1926. Development, growth, and food habits of the white sucker, Catostomus commersoni Lesueur. U.S. Bur. Fish. Bull. 42:147-181.

Whittaker, R.H. and C.W. Fairbanks, 1958. A study of plankton copepod communities in the Columbia Basin, Southeastern Washington. Ecology 39:46-65.

Woolf, C.M. 1968. Principles of biometry. Van Nostrand Co., Lts., Toronto, Canada. 359 pp.

Table 4.1-1

List of scientific and common names and classification of ichthyoplankton collected by 0.5 m net during entrainment studies in the TMINS Unit 1 Intake pump suction bay, March through August 1977.

Scientific Name	Common Name
Cyprinidae	Minnows and Carps
Campostoma/*Nocomis*/*Semotilus*	Stoneroller/River chub/Creek chub/Fallfish
Cyprinus carpio Linnaeus	Carp
Notemigonus crysoleucas (Mitchill)	Golden shiner
Notropis amoenus (Abbott)	Comely shiner
Notropis hudsonius (Clinton)	Spottail shiner
Notropis spilopterus (Cope)	Spotfin shiner
Semotilus corporalis (Mitchell)	Fallfish
Catostomidae	Suckers
Carpiodes cyprinus (Lesueur)	Quillback
Catostomus commersoni (Lacepede)	White sucker
Moxostoma macrolepidotum (Lesueur)	Shorthead redhorse
Ictaluridae	Freshwater catfishes
Ictalurus punctatus (Rafinesque)	Channel catfish
Centrarchidae	Sunfishes
Ambloplites rupestris (Rafinesque)	Rock bass
Lepomis auritus (Linnaeus)	Redbreast sunfish
Lepomis gibbosus (Linnaeus)/*Lepomis macrochirus* Rafinesque	Pumpkinseed/Bluegill
Micropterus dolomieui Lacepede	Smallmouth bass
Percidae	Perches
Etheostoma olmstedi Storer	Tessellated darter
Etheostoma zonale (Cope)	Banded darter
Percina peltata (Stauffer)	Shield darter
Stizostedion vitreum vitreum (Mitchill)	Walleye

Table 4.1-2

Location of zones I through IV of Transect TM-LF-13A3 in the center channel of York Haven Pond off the TMINS Unit 1 Intake.

Transect	Location	Zone No.	Location
TM-LF-13A3	A line running due east-west at 40° 09' 16" N passing through a point at the northwest corner of the TMINS Unit 1 Intake.	I	West shore of TMI to a point 20 m offshore. *
		II	From a point 20 m off the west shore of TMI to a point 162.5 m offshore (midchannel).
		III	From a point 162.5 m offshore to a point 20 m off the east shore of Shelley Island.
		IV	East shore of Shelley Island to a point 20 m offshore.

* All zones form a plane from the surface of the water to the river bed.

Table 4.2-1

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 16-17 March 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1025		1015		1602		1556	
River Stage (m)	3.81				7.5			
Water Temp. (C)	7.5				14.4			
Dissolved Oxygen (ppm)	13.8				8.8			
pH	8.8							
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.3	3.2	3.4	3.3	3.3	3.2	3.2	3.3
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

Table 4.2-1 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2152		2149		0352		0347	
River Stage (m)	7.5				3.33			
Water Temp. (C)	13.6				7.5			
Dissolved Oxygen (ppm)	8.9				14.1			
pH					8.4			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.2	3.2	3.6	3.4	3.4	3.2	3.3	3.2
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

Table 4.2-2

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 30-31 March 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1005		0955		1600		1556	
River Stage (m)			2.34					
Water Temp. (C)			9.0				10.0	
Dissolved Oxygen (ppm)			12.4				13.0	
pH			8.4				8.0	
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.4	3.4	3.4	3.3	3.5	3.6	2.9	3.5
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

Table 4.2-2 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2210		2205		0350		0342	
River Stage (m)			10.0				3.12	
Water Temp. (C)			12.6				10.0	
Dissolved Oxygen (ppm)			8.1				12.6	
pH							8.1	
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.3	3.5	3.6	3.5	3.4	3.2	3.2	3.2
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

Table 4.2-3

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 14-15 April 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1025		1018		1612		1605	
River Stage (m)	1.74				16.0			
Water Temp. (C)	14.5				10.8			
Dissolved Oxygen (ppm)	10.8				8.1			
pH	8.1							
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.5	3.6	3.4	3.5	3.7	3.6	3.8	3.2
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

Table 4.2-3 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2214		2207		0336		0330	
River Stage (m)					1.66			
Water Temp. (C)	16.0				16.0			
Dissolved Oxygen (ppm)	10.8				10.9			
pH	8.3				8.3			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.4	3.4	3.5	3.4	3.5	3.6	3.4	3.2
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

Table 4.2-4

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 27-28 April 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	0945		0935		1620		1616	
River Stage (m)	2.36				15.0			
Water Temp. (C)	15.5				11.2			
Dissolved Oxygen (ppm)	10.2				8.3			
pH	8.6							
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.4	3.2	3.4	3.5	3.5	3.4	4.0	3.6
Density (n/100m^3)	58.82	-	-	28.57	-	88.24	-	27.78
Mean Density	29.41		14.28		44.12		13.89	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Catostomus commersoni	- -	- -	- -	- -	- -	- -	- -	- -
Percina peltata	2 58.82	- -	- -	1 28.57	- -	3 88.24	- -	1 27.78
Stizostedion vitreum vitreum	- -	- -	- -	- -	- -	- -	- -	- -
Total Larvae	2 58.82	- -	- -	1 28.57	- -	3 88.24	- -	1 27.78
YOUNG	NO YOUNG TAKEN							
TOTAL	2	-	-	1	-	3	-	1

Table 4.2-4 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2206		2202		0623		0615	
River Stage (m)	14.5				2.26			
Water Temp. (C)	11.2				14.0			
Dissolved Oxygen (ppm)	8.4				11.2			
pH					8.4			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.6	3.3	3.7	3.8	3.4	3.6	3.2	3.2
Density (n/100m^3)	-	30.30	-	-	58.82	-	62.50	-
Mean Density	15.15		-		29.91		31.25	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Catostomus commersoni	- -	1 30.30	- -	- -	- -	- -	- -	- -
Percina peltata	- -	- -	- -	- -	2 58.82	- -	1 31.25	- -
Stizostedion vitreum vitreum	- -	- -	- -	- -	- -	- -	1 31.25	- -
Total Larvae	- -	1 30.30	- -	- -	2 58.82	- -	2 62.50	- -
YOUNG	NO YOUNG TAKEN							
TOTAL	-	1	-	-	2	-	2	-

Table 4.2-5

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 11-12 May 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	0950		0945		1546		1540	
River Stage (m)	1.51							
Water Temp. (C)	14.5				15.5			
Dissolved Oxygen (ppm)	11.4				11.4			
pH	8.4				8.4			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.4	3.2	3.4	3.5	3.5	3.4	4.0	3.6
Density (n/100m^3)	29.41	-	29.41	-	28.57	147.06	200.00	27.78
Mean Density	14.70		14.70		87.82		113.89	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Notropis hudsonius	- -	- -	- -	- -	- -	- -	- -	- -
Carpiodes cyprinus	- -	- -	1 29.41	- -	- -	- -	- -	- -
Catostomus commersoni	1 29.41	- -	- -	- -	1 28.57	3 88.24	5 125.00	- -
Etheostoma olmstedi	- -	- -	- -	- -	- -	- -	- -	1 27.78
Percina peltata	- -	- -	- -	- -	- -	2 58.82	3 75.00	- -
Total Larvae	1 29.41	- -	1 29.41	- -	1 28.57	5 147.06	8 200.00	1 27.78
YOUNG	NO YOUNG TAKEN							
TOTAL	1	-	1	-	1	5	8	1

Table 4.2-5 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2200		2155		0411		0405	
River Stage (m)					1.49			
Water Temp. (C)	16.0				15.0			
Dissolved Oxygen (ppm)	11.4				11.4			
pH	8.4				8.4			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.6	3.3	3.7	3.8	3.4	3.6	3.2	3.2
Density (n/100m^3)	55.56	60.61	135.14	52.63	88.24	83.33	62.50	31.25
Mean Density	58.08		93.88		85.78		46.88	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Notropis hudsonius	- -	- -	- -	- -	- -	1 27.78	- -	- -
Carpiodes cyprinus	- -	- -	1 27.03	- -	- -	- -	- -	- -
Catostomus commersoni	- -	- -	2 54.05	1 26.32	1 29.41	1 27.78	1 31.25	- -
Etheostoma olmstedi	- -	- -	- -	- -	- -	- -	- -	- -
Percina peltata	2 55.56	2 60.61	2 54.05	1 26.32	2 58.82	1 27.78	1 31.25	1 31.25
Total Larvae	2 55.56	2 60.61	5 135.14	2 52.63	3 88.24	3 83.33	2 62.50	1 31.25
YOUNG	NO YOUNG TAKEN							
TOTAL	2	2	5	2	3	3	2	1

Table 4.2-6

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 25-26 May 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1010		1003		1606		1600	
River Stage (m)			1.22					
Water Temp. (C)			24.0				25.0	
Dissolved Oxygen (ppm)			7.8				9.4	
pH			8.3				8.3	
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.5	3.6	3.6	3.9	3.8	3.6	3.6	3.8
Density (n/100m^3)	1000.00	694.44	916.67	769.23	263.16	194.44	611.11	289.47
Mean Density	847.22		842.95		228.80		450.29	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Campostoma/Nocomis/Semotilus	- -	- -	- -	1 25.64	- -	- -	- -	- -
Cyprinus carpio	8 228.57	1 27.78	2 55.56	2 51.28	- -	- -	1 27.78	- -
Notemigonus crysoleucas	- -	- -	- -	- -	- -	- -	- -	- -
Notropis amoenus	- -	- -	- -	- -	- -	- -	- -	- -
N. hudsonius	17 485.71	5 138.89	12 333.33	1 25.64	1 26.32	- -	1 27.78	1 26.32
N. spilopterus	- -	- -	- -	- -	- -	- -	- -	- -
Semotilus corporalis	- -	- -	- -	- -	- -	- -	1 27.78	- -
Carpiodes cyprinus	1 28.57	- -	4 111.11	1 25.64	- -	- -	- -	- -
Catostomus commersoni	- -	1 27.78	3 83.33	2 51.28	4 105.26	2 55.56	4 111.11	2 52.63
Moxostoma macrolepidotum	- -	- -	- -	- -	2 52.63	4 111.11	- -	- -
Lepomis gibbosus/L. macrochirus	2 57.14	1 27.78	- -	4 102.56	- -	- -	- -	1 26.32
Etheostoma olmstedi	- -	- -	- -	- -	- -	- -	- -	- -
E. zonale	3 85.71	9 250.00	7 194.44	12 307.69	1 26.32	- -	- -	- -
Percina peltata	4 114.29	8 222.22	5 138.89	7 179.49	2 52.63	- -	15 416.67	7 184.21
Total Larvae	35 1000.00	25 694.44	33 916.67	30 769.23	10 263.16	6 166.67	22 611.11	11 289.47
YOUNG								
Catostomus commersoni	- -	- -	- -	- -	- -	1 27.78	- -	- -
Total Young	- -	- -	- -	- -	- -	1 27.78	- -	- -
TOTAL		25	33	30	10	7	22	11

Table 4.2-6 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2206		2200		0349		0342	
River Stage (m)					1.19			
Water Temp. (C)	25.0				24.5			
Dissolved Oxygen (ppm)	9.6				8.9			
pH	8.6				8.6			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.2	3.6	3.6	4.0	3.6	3.4	3.9	3.7
Density ($n/100m^3$)	312.50	416.67	277.78	350.00	444.44	647.06	512.82	378.38
Mean Density	364.58		313.89		545.75		445.60	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Campostoma/Nocomis/Semotilus	- -	- -	- -	- -	- -	- -	- -	- -
Cyprinus carpio	7 218.75	2 55.56	4 111.11	1 25.00	3 83.33	7 205.88	6 153.85	1 27.03
Notemigonus crysoleucas	- -	- -	- -	- -	- -	1 29.41	- -	- -
Notropis amoenus	- -	- -	- -	- -	1 27.78	- -	- -	1 27.03
N. hudsonius	1 31.25	6 166.67	4 111.11	9 225.00	5 138.89	7 205.88	7 179.49	3 81.08
N. spilopterus	- -	- -	- -	- -	- -	1 29.41	- -	- -
Semotilus corporalis	- -	- -	- -	- -	- -	- -	- -	- -
Carpiodes cyprinus	- -	- -	- -	- -	1 27.78	2 58.82	2 51.28	1 27.03
Catostomus commersoni	1 31.25	- -	- -	- -	- -	- -	1 25.64	- -
Moxostoma macrolepidotum	- -	- -	- -	- -	- -	- -	- -	- -
Lepomis gibbosus/L. macrochirus	- -	- -	- -	- -	1 27.78	- -	- -	- -
Etheostoma olmstedi	- -	- -	- -	- -	- -	- -	- -	1 27.03
E. zonale	- -	1 27.78	1 27.78	- -	4 111.11	1 29.41	1 25.64	5 135.14
Percina peltata	1 31.25	6 166.67	1 27.78	4 100.00	1 27.78	3 88.24	3 76.92	2 54.05
Total Larvae	10 312.50	15 416.67	10 277.78	14 350.00	16 444.44	22 647.06	20 512.82	14 378.38
YOUNG								
Catostomus commersoni	- -	- -	- -	- -	- -	- -	- -	- -
Total Young	- -	- -	- -	- -	- -	- -	- -	- -
TOTAL	10	15	10	14	16	22	20	14

Table 4.2-7

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 16-17 June 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1033		1025		1534		1530	
River Stage (m)	1.10							
Water Temp. (C)	22.0				24.5			
Dissolved Oxygen (ppm)	9.8				NA			
pH	8.5				8.9			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.6	3.5	3.2	3.6	3.7	3.4	3.3	3.5
Density (n/100m^3)	27.78	28.57	61.25	55.56	81.08	58.82	30.30	28.57
Mean Density	28.18		58.40		69.95		29.44	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Notropis hudsonius	- -	1 28.57	- -	- -	1 27.03	- -	1 30.30	- -
N. spilopterus	- -	- -	- -	- -	- -	- -	- -	- -
Ambloplites rupestris	- -	- -	- -	- -	- -	1 29.41	- -	- -
Lepomis gibbosus/L. macrochirus	1 27.78	- -	- -	2 55.56	- -	1 29.41	- -	1 28.57
Etheostoma zonale	- -	- -	1 31.25	- -	- -	- -	- -	- -
Total Larvae	1 27.78	1 28.57	1 31.25	2 55.56	1 27.03	2 58.82	1 30.30	1 28.57
YOUNG								
Notropis hudsonius	- -	- -	1 31.25	- -	1 27.03	- -	- -	- -
Catostomus commersoni	- -	- -	- -	- -	- -	- -	- -	- -
Ictalurus punctatus	- -	- -	- -	- -	- -	- -	- -	- -
Micropterus dolomieui	- -	- -	- -	- -	1 27.03	- -	- -	- -
Percina peltata	- -	- -	- -	- -	- -	- -	- -	- -
Total Young	- -	- -	1 31.25	- -	2 54.05	- -	- -	- -
TOTAL	1	1	2	2	3	2	1	1

Table 4.2-7 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2213		2204		0356		0346	
River Stage (m)					1.09			
Water Temp. (C)			25.0		25.0			
Dissolved Oxygen (ppm)			11.0		13.0			
pH			8.9		8.9			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.5	3.4	3.4	3.5	3.1	3.5	3.5	3.3
Density ($n/100m^3$)	171.43	58.82	117.65	28.57	64.52	285.71	-	151.52
Mean Density	115.12		73.11		175.12		75.76	
	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
LARVAE								
Notropis hudsonius	2 57.14	- -	1 29.41	- -	- -	- -	- -	1 30.30
N. spilopterus	- -	- -	- -	- -	- -	2 57.14	- -	- -
Ambloplites rupestris	- -	- -	- -	- -	- -	- -	- -	- -
Lepomis gibbosus/L. macrochirus	3 85.71	- -	3 88.24	- -	2 64.52	6 171.43	- -	2 60.60
Etheostoma zonale	1 28.57	- -	- -	- -	- -	- -	- -	1 30.30
Total Larvae	6 171.43	- -	4 117.65	- -	2 64.52	8 228.57	- -	4 121.21
YOUNG								
Notropis hudsonius	- -	2 58.82	- -	- -	- -	- -	- -	1 30.30
Catostomus commersoni	- -	- -	- -	- -	- -	1 28.57	- -	- -
Ictalurus punctatus	- -	- -	- -	1 28.57	- -	- -	- -	- -
Micropterus dolomieui	- -	- -	- -	- -	- -	- -	- -	- -
Percina peltata	- -	- -	- -	- -	- -	1 28.57	- -	- -
Total Young	- -	2 58.82	- -	1 28.57	- -	2 57.14	- -	1 30.30
TOTAL	6	2	4	1	2	10	-	5

NA Not Available.

Table 4.2-8

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 29-30 June 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1012		0956		1547		1539	
River Stage (m)	1.19				26.0			
Water Temp. (C)	25.0				9.4			
Dissolved Oxygen (ppm)	7.7				8.4			
pH	8.3							
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.4	3.4	3.2	3.0	3.4	3.5	3.5	3.2
Density (n/100m^3)	1058.82	529.41	312.50	266.67	29.41	114.29	-	31.25
Mean Density	794.12		289.59		71.85		15.63	
LARVAE	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
Notemigonus crysoleucas	- -	- -	- -	- -	1 29.41	- -	- -	- -
Notropis spilopterus	- -	1 29.41	- -	1 33.33	- -	2 57.14	- -	- -
Lepomis auritus	- -	- -	- -	- -	- -	- -	- -	- -
L. gibbosus/L. macrochirus	36 1058.82	17 500.00	10 312.50	7 233.33	- -	2 57.14	- -	- -
Etheostoma zonale	- -	- -	- -	- -	- -	- -	- -	1 31.25
Total Larvae	36 1058.82	18 529.41	10 312.50	8 266.67	1 29.41	4 114.29	- -	1 31.25
YOUNG	NO YOUNG TAKEN							
TOTAL	18		10	8	1	4	-	1

Table 4.2-8 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2225		2216		0355		0345	
River Stage (m)	26.0				1.18			
Water Temp. (C)	9.6				25.0			
Dissolved Oxygen (ppm)	8.2				8.2			
pH					8.2			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.3	3.3	3.1	2.9	3.3	3.2	3.1	3.4
Density (n/100m^3)	90.91	121.21	-	34.48	121.21	250.00	129.03	176.47
Mean Density	106.06		17.24		185.61		152.75	
LARVAE	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
Notemigonus crysoleucas	- -	- -	- -	- -	- -	- -	- -	- -
Notropis spilopterus	1 30.30	1 30.30	- -	1 34.48	4 121.21	5 156.25	2 64.52	6 176.47
Lepomis auritus	- -	- -	- -	- -	- -	- -	1 32.26	- -
L. gibbosus/L. macrochirus	2 60.61	2 60.61	- -	- -	- -	3 93.75	1 32.26	- -
Etheostoma zonale	- -	1 30.30	- -	- -	- -	- -	- -	- -
Total Larvae	3 90.91	4 121.21	- -	1 34.48	4 121.21	8 250.00	4 129.03	6 176.47
YOUNG	NO YOUNG TAKEN							
TOTAL	3	4	-	1	4	8	4	6

Table 4.2-9

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 13-14 July 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1020		1015		1554		1547	
River Stage (m)			1.26					
Water Temp. (C)			27.0				27.0	
Dissolved Oxygen (ppm)			8.5				11.0	
pH			8.7				8.5	
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.7	3.5	3.1	3.2	3.8	3.6	3.8	3.5
Density (n/100^3)	27.03	57.14	-	-	-	-	-	-
Mean Density	40.59		-				-	
LARVAE	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
Notropis spilopterus	1 27.03	2 57.14	- -	- -	- -	- -	- -	- -
Lepomis gibbosus/L. macrochirus	- -	- -	- -	- -	- -	- -	- -	- -
Total Larvae	1 27.03	2 57.14	- -	- -	- -	- -	- -	- -
YOUNG	NO YOUNG TAKEN							
TOTAL	1	2	-	-	-	-	-	-

Table 4.2-9 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2217		2211		0426		0415	
River Stage (m)			27.0				1.34	
Water Temp. (C)			9.8				26.0	
Dissolved Oxygen (ppm)			8.5				8.5	
pH							8.5	
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.5	3.7	3.6	3.8	3.4	3.5	3.1	3.2
Density (n/100 m^3)	28.57	54.05	27.78	52.63	29.41	28.57	96.77	-
Mean Density	41.31		40.21		28.99		48.39	
LARVAE	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
Notropis spilopterus	- -	2 54.05	1 27.78	2 52.63	1 29.41	1 28.57	3 96.77	- -
Lepomis gibbosus/L. macrochirus	1 28.57	- -	- -	- -	- -	- -	- -	- -
Total Larvae	1 28.57	2 54.05	1 27.78	2 52.63	1 29.41	1 28.57	3 96.77	- -
YOUNG	NO YOUNG TAKEN							
TOTAL	1	2	1	2	1	1	3	-

Table 4.2-10

Number (n) and density (n/100m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 25-26 July 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1015		1010		1603		1556	
River Stage (m)								
Water Temp. (C)	1.33							
Dissolved Oxygen (ppm)	25.0							
pH	7.8				25.0			
Replicate	8.1				8.2			
Volume Sampled (m^3)	8.2							
Density (n/100m^3)	a	b	a	b	a	b	a	b
Mean Density	3.3	3.4	3.0	3.2	3.3	3.2	3.2	3.3
	30.30	58.82	66.67	93.75	30.30	-	-	-
	44.56		80.21		15.15		-	
LARVAE	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
Notropis spilopterus	1 30.30	2 58.82	2 66.67	3 93.75	1 30.30	- -	- -	- -
Total Larvae	1 30.30	2 58.82	2 66.67	3 93.75	1 30.30	- -	- -	- -
YOUNG								
Ictalurus punctatus	- -	- -	- -	- -	- -	- -	- -	- -
Total Young	- -	- -	- -	- -	- -	- -	- -	- -
TOTAL	1	2	2	3	1	-	-	-

Table 4.2-10 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2210		2203		0352		0345	
River Stage (m)								
Water Temp. (C)	25.5				1.30			
Dissolved Oxygen (ppm)	8.6				25.5			
pH	8.1				7.4			
Replicate					8.1			
Volume Sampled (m^3)	a	b	a	b	a	b	a	b
Density (n/100m^3)	3.4	3.3	3.5	3.1	3.5	3.4	3.6	3.5
Mean Density	29.41	-	-	64.52	428.57	411.76	222.22	228.57
	14.70		32.36		420.16		225.40	
LARVAE	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3	n n/100m^3
Notropis spilopterus	1 29.41	- -	- -	2 64.52	15 428.57	14 411.76	8 222.22	7 200.00
Total Larvae	1 29.41	- -	- -	2 64.52	15 428.57	14 411.76	8 222.22	7 200.00
YOUNG								
Ictalurus punctatus	- -	- -	- -	- -	- -	- -	- -	1 28.57
Total Young	- -	- -	- -	- -	- -	- -	- -	1 28.57
TOTAL	1	-	-	2	15	14	8	8

Table 4.2-11

Number (n) and density (n/100 m³) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 10-11 August 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1002		0955		1550		1542	
River Stage (m)	1.11							
Water Temp. (C)	28.0				28.0			
Dissolved Oxygen (ppm)	6.9				7.8			
pH	8.6				8.2			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m³)	3.3	3.3	3.0	3.6	3.3	3.5	3.6	3.6
Density (n/100m³)	60.61	212.12	66.67	83.33	-	-	-	-
Mean Density	136.37		75.00		-		-	
	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³
LARVAE								
Notropis spilopterus	- -	- -	1 33.33	- -	- -	- -	- -	- -
Lepomis auritus	- -	- -	- -	1 27.78	- -	- -	- -	- -
L. gibbosus/L. macrochirus	2 60.61	7 212.12	1 33.33	2 55.56	- -	- -	- -	- -
Total Larvae	2 60.61	7 212.12	2 66.67	3 83.33	- -	- -	- -	- -
YOUNG	NO YOUNG TAKEN							
TOTAL	2	7	2	3	-	-	-	-

Table 4.2-11 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2216		2208		0354		0345	
River Stage (m)					1.20			
Water Temp. (C)	28.0				28.0			
Dissolved Oxygen (ppm)	8.6				8.3			
pH	8.7				8.7			
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m³)	3.3	3.3	3.3	3.5	3.4	3.4	3.6	3.4
Density (n/100m³)	-	121.21	-	57.14	88.24	117.65	83.33	29.41
Mean Density	60.61		28.57		102.95		56.37	
	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³	n n/100m³
LARVAE								
Notropis spilopterus	- -	1 30.30	- -	2 57.14	2 58.82	4 117.65	2 55.56	1 29.41
Lepomis auritus	- -	- -	- -	- -	- -	- -	- -	- -
L. gibbosus/L. macrochirus	- -	3 90.91	- -	- -	1 29.41	- -	1 27.78	- -
Total Larvae	- -	4 121.21	- -	2 57.14	3 88.24	4 117.65	3 83.33	1 29.41
YOUNG	NO YOUNG TAKEN							
TOTAL	-	4	-	2	3	4	3	1

Table 4.2-12

Number (n) and density (n/100 m^3) of ichthyoplankton taken by 0.5 m net in the TMINS Unit 1 Intake suction bay on 24-25 August 1977.

Time Period	1000				1600			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	1028		1020		1543		1534	
River Stage (m)			1.16				24.0	
Water Temp. (C)			NA				7.7	
Dissolved Oxygen (ppm)			NA				8.5	
pH			NA					
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	1.6	3.4	3.2	3.5	3.5	3.5	3.4	3.1
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

Table 4.2-12 continued.

Time Period	2200				0400			
Station	SURFACE		OBLIQUE		SURFACE		OBLIQUE	
Time	2216		2209		0400		0352	
River Stage (m)			23.5				1.12	
Water Temp. (C)			7.0				23.0	
Dissolved Oxygen (ppm)			8.5				7.0	
pH							8.5	
Replicate	a	b	a	b	a	b	a	b
Volume Sampled (m^3)	3.5	3.3	3.3	3.5	3.6	3.5	3.3	3.1
LARVAE	NO LARVAE TAKEN							
YOUNG	NO YOUNG TAKEN							

NA Not available.

Table 4.2-13

Summary of mean density (n/100 m^3) of ichthyoplankton taken by 0.5 m net during entrainment studies at TMINS Unit 1 Intake, 27 April through 11 August 1977.

	Apr 27-28	May 11-12	May 25-26	Jun 16-17	Jun 29-30	Jul 13-14	Jul 25-26	Aug 10-11
				SURFACE				
LARVAE								
Cyprinus carpio	-	-	102.48	-	-	-	-	-
Notemigonus crysoleucas	-	-	3.68	-	3.68	-	-	-
Notropis amoenus	-	-	3.47	-	-	-	-	-
N. hudsonius	-	3.47	149.20	14.09	-	-	-	-
N. spilopterus	-	-	3.68	7.14	53.08	24.15	123.65	25.85
Carpiodes cyprinus	-	-	14.40	-	-	-	-	-
Catostomus commersoni	3.79	25.43	27.48	-	-	-	-	-
Moxostoma macrolepidotum	-	-	20.47	-	-	-	-	-
Ambloplites rupestris	-	-	-	3.68	-	-	-	-
Lepomis gibbosus/L. macrochirus	-	-	14.09	47.36	228.87	3.57	-	49.13
Etheostoma zonale	-	-	66.29	3.57	3.79	-	-	-
Percina peltata	25.74	32.70	87.89	-	-	-	-	-
Total Larvae	29.52	61.60	493.12	75.84	289.41	27.72	123.65	74.98
YOUNG								
Notropis hudsonius	-	-	-	10.73	-	-	-	-
Catostomus commersoni	-	-	3.47	3.57	-	-	-	-
Micropterus dolomieui	-	-	-	3.37	-	-	-	-
Percina peltata	-	-	-	3.57	-	-	-	-
Total Young	-	-	3.47	21.25	-	-	-	-
TOTAL	29.52	61.60	496.59	97.09	289.41	27.72	123.65	74.98
				OBLIQUE				
LARVAE								
Campostoma/Nocomis/Semotilus	-	-	3.21	-	-	-	-	-
Cyprinus carpio	-	-	56.45	-	-	-	-	-
Notropis amoenus	-	-	3.38	-	-	-	-	-
N. hudsonius	-	-	126.22	11.25	-	-	-	-
N. spilopterus	-	-	-	-	38.60	22.15	80.90	21.93
Semotilus corporalis	-	-	3.47	-	-	-	-	-
Carpiodes cyprinus	-	7.06	26.88	-	-	-	-	-
Catostomus commersoni	-	29.58	40.50	-	-	-	-	-
Lepomis auritus	-	-	-	-	4.03	-	-	3.47
L. gibbosus/L. macrochirus	-	-	16.11	29.12	76.17	-		14.58
Etheostoma olmstedi	-	3.47	3.38	-	-	-	-	-
E. zonale	-	-	86.34	7.69	-	-	-	-
Percina peltata	10.95	27.23	147.25	-	-	-	-	-
Stizostedion vitreum vitreum	3.91	-	-	-	-	-	-	-
Total Larvae	14.86	67.34	513.18	48.07	118.80	22.15	80.90	39.99
YOUNG								
Notropis hudsonius	-	-	-	7.69	-	-	-	-
Ictalurus punctatus	-	-	-	3.57	-	-	3.57	-
Total Young	-	-	-	11.27	-	-	3.57	-
TOTAL	14.86	67.34	513.18	59.18	118.80	22.15	84.47	39.99

Table 4.2-14

Summary of mean density (n/100 m^3) by family of ichthyoplankton taken by 0.5 m net at 1000, 1600, 2200, and 0400 h in surface (S) and oblique (O) tows during entrainment studies at TMINS Unit 1 Intake, 27 April through 11 August 1977.

		Cyprinidae				Catostomidae				Ictaluridae			
		1000	1600	2200	0400	1000	1600	2200	0400	1000	1600	2200	0400
27-28 Apr	S	-	-	-	-	-	-	15.15	-	-	-	-	-
	O	-	-	-	-	-	-	-	-	-	-	-	-
11-12 May	S	-	-	-	13.89	14.71	58.41	-	28.60	-	-	-	-
	O	-	-	-	-	14.71	62.50	53.70	15.63	-	-	-	-
25-26 May	S	440.48	13.16	236.12	360.30	28.18	176.17	15.63	43.30	-	-	-	-
	O	245.73	54.83	236.11	234.24	135.68	81.87	-	51.98	-	-	-	-
16-17 Jun	S	14.29	27.03	57.98	28.57	-	-	-	14.29	-	-	-	-
	O	15.63	15.15	14.71	30.30	-	-	-	-	-	-	14.29	-
29-30 Jun	S	14.71	43.28	30.30	138.73	-	-	-	-	-	-	-	-
	O	16.67	-	17.24	120.50	-	-	-	-	-	-	-	-
13-14 Jul	S	40.59	-	27.03	28.99	-	-	-	-	-	-	-	-
	O	-	-	40.21	48.39	-	-	-	-	-	-	-	-
25-26 Jul	S	44.56	15.15	14.71	420.17	-	-	-	-	-	-	-	-
	O	80.21	-	32.26	211.11	-	-	-	-	-	-	-	14.29
10-11 Aug	S	-	-	15.15	88.24	-	-	-	-	-	-	-	-
	O	16.67	-	28.57	42.49	-	-	-	-	-	-	-	-

Table 4.2-14 continued.

		Centrarchidae				Percidae				Total			
		1000	1600	2200	0400	1000	1600	2200	0400	1000	1600	2200	0400
27-28 Apr	S	-	-	-	-	29.41	44.12	-	29.41	29.41	44.12	15.15	29.41
	O	-	-	-	-	14.29	13.89	-	31.25	14.29	13.89	-	31.25
11-12 May	S	-	-	-	-	-	29.41	58.09	43.30	14.71	87.82	58.09	85.79
	O	-	-	-	-	-	51.39	40.19	31.25	14.71	113.89	93.89	46.88
25-26 May	S	42.46	-	-	13.89	336.11	39.48	112.85	128.27	847.23	228.81	364.60	545.76
	O	51.28	13.16	-	-	410.26	300.44	77.78	159.39	842.95	450.30	313.89	445.61
16-17 Jun	S	13.89	42.93	42.86	117.98	-	-	14.29	14.29	28.18	69.96	115.13	175.13
	O	27.78	14.29	44.12	30.30	15.63	-	-	15.15	59.04	29.44	73.12	75.75
29-30 Jun	S	779.41	28.57	60.61	46.88	-	-	15.15	-	794.12	71.85	106.06	185.61
	O	272.92	15.63	-	32.26	-	-	-	-	289.59	15.63	17.24	152.76
13-14 Jul	S	-	-	14.29	-	-	-	-	-	40.59	-	41.32	28.99
	O	-	-	-	-	-	-	-	-	-	-	40.21	48.39
25-26 Jul	S	-	-	-	-	-	-	-	-	44.56	15.15	14.71	420.17
	O	-	-	-	-	-	-	-	-	80.21	-	32.26	225.40
10-11 Aug	S	136.37	-	45.46	14.71	-	-	-	-	136.37	-	60.61	102.95
	O	58.34	-	-	13.89	-	-	-	-	75.01	-	28.57	56.38

Table 4.2-15

Length frequency distribution (1.0 mm interval) of ichthyoplankton taken by 0.5 m net during entrainment studies at TMINS Unit 1 Intake in 1977.

Total Length (mm)	Cyprinus carpio Life* Stage	May 25-26	Notropis hudsonius Life Stage	May 25-26	Jun 16-17	Notropis spilopterus Life Stage	May 25-26	Jun 16-17	Jun 29-30	Jul 13-14	Jul 25-26	Aug 10-11	Catostomus commersoni Life Stage	Apr 27-28	May 11-12	May 25-26	Jun 16-17
4.1-5.0	P	2	P	26	-	P	-	-	-	-	3	1		-	-	-	-
5.1-6.0		9		42	-		-	2	13	6	44	10		-	-	-	-
6.1-7.0		20	P/Ms	8	-	P/Ms	1	-	8	5	5	2		-	-	-	-
7.1-8.0		13	Ms	2	-	Ms	-	-	1	2	2	-		-	-	-	-
8.1-9.0	Ms	1		1	-		-	-	1	-	1	-	P	-	1	-	-
9.1-10.0		-	Mt	1	-		-	-	-	-	-	-		-	-	-	-
10.1-11.0		-		-	-		-	-	-	-	-	-		-	-	-	-
11.1-12.0		-		-	1		-	-	-	-	-	-		-	1	-	-
12.1-13.0		-		-	4	Mt	-	-	1	-	-	-		-	1	-	-
13.1-14.0		-		-	1		-	-	-	-	-	-	Ms	1	5	-	-
14.1-15.0		-		-	1		-	-	-	-	-	-		-	7	2	-
15.1-16.0		-	Y	-	2		-	-	-	-	-	-		-	1	2	-
16.1-17.0		-		-	1		-	-	-	-	-	-	Ms/Mt	-	1	4	-
17.1-18.0		-		-	1		-	-	-	-	-	-	Mt	-	-	3	-
18.1-19.0		-		-	1		-	-	-	-	-	-		-	-	5	-
19.1-20.0		-		-	-		-	-	-	-	-	-		-	-	3	-
20.1-21.0		-		-	-		-	-	-	-	-	-		-	-	-	-
21.1-22.0		-		-	-		-	-	-	-	-	-	Mt/Y	-	-	2	-
22.1-23.0		-		-	-		-	-	-	-	-	-	Y	-	-	-	1
23.1-24.0		-		-	-		-	-	-	-	-	-		-	-	-	-
24.1-25.0		-		-	-		-	-	-	-	-	-		-	-	-	-

Table 4.2-15 continued.

Total Length (mm)	Lepomis gibbosus/L. macrochirus Life Stage	May 25-26	Jun 16-17	Jun 29-30	Jul 13-14	Jul 25-26	Aug 10-11	Etheostoma zonale Life Stage	May 25-26	Jun 16-17	Jun 29-30	Percina peltata Life Stage	Apr 27-28	May 11-12	May 25-26	Jun 16-17
4.1-5.0	P	5	-	-	-		-		-	-	-		-	-	-	-
5.1-6.0		4	9	27	1		8	P	20	-	1		-	-	-	-
6.1-7.0	P/Ms	-	-	35	-		9		23	1	-	P	-	1	4	-
7.1-8.0	Ms	-	1	9	-		-		2	-	-	P/Ms	1	-	27	-
8.1-9.0		-	2	7	-		-		-	-	-	Ms	5	9	17	-
9.1-10.0		-	5	-	-	NO	-		-	-	-		4	6	5	-
10.1-11.0	Mt	-	2	1	-		-		-	-	-	Ms/Mt	-	1	10	-
11.1-12.0		-	1	-	-		-		-	-	-	Mt	-	-	3	-
12.1-13.0		-	1	1	-		-	Mt	-	1	-		-	-	2	-
13.1-14.0		-	-	-	-		-		-	-	-	Y	-	-	-	1
14.1-15.0		-	-	1	-		-		-	1	-		-	-	-	-
15.1-16.0		-	-	-	-	FISH	-		-	-	-		-	-	-	-
16.1-17.0		-	-	-	-		-		-	-	-		-	-	-	-
17.1-18.0		-	-	-	-		-		-	-	-		-	-	-	-
18.1-19.0		-	-	-	-		-		-	-	-		-	-	-	-
19.1-20.0		-	-	-	-		-		-	-	-		-	-	-	-
20.1-21.0		-	-	-	-		-		-	-	-		-	-	-	-
21.1-22.0		-	-	-	-	TAKEN	-		-	-	-		-	-	-	-
22.1-23.0		-	-	-	-		-		-	-	-		-	-	-	-
23.1-24.0		-	-	-	-		-		-	-	-		-	-	-	-
24.1-25.0		-	-	-	-		-		-	-	-		-	-	-	-

* Protolarvae, P; Mesolarvae, Ms; Metalarvae, Mt; and Young, Y.

Table 4.2-16

Results of the three-way analysis of variance performed on densities of total ichthyoplankton taken by 0.5 m net during entrainment studies at the TMINS Unit 1 Intake, 27 April through 11 August 1977.

	Date compared	Date	Depth[1]	Time[2]	Date/Depth	Date/Time	Depth/Time	Date/Depth/Time
Total Ichthyoplankton	27-28 Apr - 10-11 Aug	*	*	*	NS	*	NS	NS

1 Surface and oblique.
2 1000, 1600, 2200, and 0400 h.
* Significant at 0.05 level.
NS Not Significant.

Table 4.2-17

Results of Student-Newman-Kuels multirange test performed on the mean densities of total ichthyoplankton taken by 0.5 m net during entrainment studies at the TMINS Unit 1 Intake in 1977. Sample dates and times underscored showed no significant difference (P = 0.05).

	Sample Date								Time (h)			
Total Ichthyoplankton	Apr 27-28	Jul 13-14	Aug 10-11	May 11-12	Jun 16-17	Jul 25-26	Jun 29-30	May 25-26	1600	2200	0400	1000

Table 4.2-18

Summary of mean density (n/100 m^3) and percent composition (%) by family of ichthyoplankton taken in surface (S) and oblique (O) tows by 0.5 m net during entrainment studies at TMINS Unit 1 Intake, 27 April and 11 August 1977.

		Cyprinidae		Catostomidae		Ictaluridae		Centrarchidae		Percidae		Total
		n/100m^3	%	n/100m^3	%	n/100m^3	%	n/100m^3	%	n/100m^3	%	n/100m^3
27-28 Apr	S	-	-	3.79	12.8	-	-	-	-	25.74	87.2	29.52
	O	-	-	-	-	-	-	-	-	14.86	100.0	14.86
11-12 May	S	3.47	5.6	25.43	41.3	-	-	-	-	32.70	53.1	61.60
	O	-	-	36.64	54.4	-	-	-	-	30.70	45.6	67.34
25-26 May	S	262.51	52.9	65.82	13.3	-	-	14.09	2.8	154.18	31.0	496.59
	O	192.73	37.6	67.38	13.1	-	-	16.11	3.1	236.97	46.2	513.18
16-17 Jun	S	31.96	32.9	3.57	3.7	-	-	54.41	56.0	7.14	7.4	97.09
	O	18.94	32.0	-	-	3.57	6.0	29.12	49.2	7.69	13.0	59.32
29-30 Jun	S	56.76	19.6	-	-	-	-	228.87	79.1	3.79	1.3	289.41
	O	38.60	32.5	-	-	-	-	80.20	67.5	-	-	118.80
13-14 Jul	S	24.15	87.1	-	-	-	-	3.57	12.9	-	-	27.72
	O	22.15	100.0	-	-	-	-	-	-	-	-	22.15
25-26 Jul	S	123.65	100.0	-	-	-	-	-	-	-	-	123.65
	O	80.90	95.8	-	-	3.57	4.2	-	-	-	-	84.47
10-11 Aug	S	25.85	34.5	-	-	-	-	49.13	65.5	-	-	74.98
	O	21.93	54.8	-	-	-	-	18.05	45.1	-	-	39.99
Mean	S	66.04	44.0	12.33	8.2	-	-	43.76	29.2	27.94	18.6	150.07
	O	46.91	40.8	13.00	11.3	0.89	1.0	17.94	15.6	36.28	31.5	115.01

Table 4.2·19

Summary of mean density (n/100 m^3) and percent composition (%) of ichthyoplankton taken by 0.5 m net at 1000, 1600, 2200, and 0400 h in surface and oblique tows during entrainment studies at TMINS Unit 1 Intake, 27 April through 11 August 1977.

	SURFACE										OBLIQUE									
	1000		1600		2200		0400				1000		1600		2200		0400			
	n/100m^3	%	n/100m^3	%	n/100m^3	%	n/100m^3	%	N/100m^3	%	n/100m^3	%	n/100m^3	%	n/100m^3	%	n/100m^3	%	N/100m^3	%
LARVAE																				
Campostoma/Nocomis/Semotilus	-	-	-	-	-	-	-	-	-	-	1.60	0.9	-	-	-	-	-	-	0.40	0.3
Cyprinus carpio	16.02	6.6	-	-	17.15	17.7	18.08	9.3	12.81	8.6	6.68	3.9	1.74	2.2	8.51	11.4	11.31	8.5	7.06	6.2
Notemigonus crysoleucas	-	-	1.84	2.8	-	-	1.84	0.9	0.92	0.6	-	-	-	-	-	-	-	-	2.11	1.8
Notropis amoenus	-	-	-	-	-	-	1.74	0.9	0.44	0.3	-	-	-	-	-	-	1.69	1.3	0.42	0.4
N. hudsonius	40.83	16.9	3.34	5.2	15.94	16.4	23.29	11.9	20.85	13.9	22.44	13.0	5.28	6.8	22.85	30.5	18.18	13.6	17.19	15.0
N. spilopterus	12.48	5.2	5.47	8.5	10.90	11.2	89.92	46.1	29.69	19.8	14.19	8.3	-	-	14.78	19.7	52.81	39.6	20.45	17.9
Semotilus corporalis	-	-	-	-	-	-	-	-	-	-	-	-	1.74	2.2	-	-	-	-	0.44	0.4
Carpiodes cyprinus	1.79	0.7	-	-	-	-	5.41	2.8	1.80	1.2	10.39	6.0	-	-	1.69	2.3	4.89	3.7	4.24	3.7
Catostomus commersoni	3.58	1.5	17.35	26.8	3.85	4.0	3.57	1.8	7.09	4.7	8.41	4.9	18.05	23.2	5.02	6.7	3.56	2.7	8.76	7.6
Moxostoma macrolepidotum	-	-	10.24	15.8	-	-	-	-	2.56	1.7	-	-	-	-	-	-	-	-	-	-
Ambloplites rupestris	-	-	1.84	2.8	-	-	-	-	0.46	0.3	-	-	-	-	-	-	-	-	-	-
Lepomis auritus	-	-	-	-	-	-	-	-	-	-	1.74	1.0	-	-	-	-	2.02	1.5	0.94	0.8
L. gibbosus/L. macrochirus	121.52	50.2	5.41	8.4	20.40	21.0	24.18	12.4	42.88	28.7	49.55	28.8	5.38	6.9	5.52	7.4	7.54	5.7	17.00	14.8
Etheostoma olmstedi	-	-	-	-	-	-	-	-	-	-	-	-	1.74	2.2	-	-	1.69	1.3	0.86	0.8
E. zonale	20.98	8.7	1.65	2.5	5.42	5.6	8.78	4.5	9.21	6.2	33.34	19.4	-	-	1.74	2.3	11.94	9.0	11.76	10.3
Percina peltata	24.71	10.2	12.48	19.3	19.63	20.2	16.34	8.4	18.29	12.2	21.68	12.6	43.98	56.5	13.01	17.4	12.09	9.1	22.69	19.8
Stizostedion vitreum vitreum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.95	1.5	0.49	0.4
Total Larvae	241.89	100.0	59.60	92.1	93.28	96.2	193.15	99.1	146.98	98.2	170.02	98.9	77.89	100.0	73.11	97.6	129.67	97.2	112.67	98.4
YOUNG																				
Notropis hudsonius	-	-	1.69	2.6	3.68	3.8	-	-	1.34	0.9	1.95	1.1	-	-	-	-	1.89	1.4	0.96	0.8
Catostomus commersoni	-	-	1.74	2.7	-	-	-	-	0.44	0.3	-	-	-	-	-	-	-	-	-	-
Ictalurus punctatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.79	2.4	1.79	1.3	0.90	0.8
Micropterus dolomieui	-	-	1.69	2.6	-	-	-	-	0.42	0.3	-	-	-	-	-	-	-	-	-	-
Percina peltata	-	-	-	-	-	-	1.79	0.9	0.45	0.3	-	-	-	-	-	-	-	-	-	-
Total Young	-	-	5.11	7.9	3.68	3.8	1.79	0.9	2.65	1.8	1.95	1.1	-	-	1.79	2.4	3.68	2.8	1.86	1.6
TOTAL	241.89		64.71		96.96		194.94		149.63		171.97		77.89		74.90		133.35		114.53	

Table 4.2-20

Indices of percent similarity of species composition between 1000, 1600, 2200, and 0400 h and surface and oblique tows for entrainment studies at TMINS Unit 1 Intake, March through August 1977.

				OBLIQUE					
				1000	72.0	43.0	69.5	54.0	
			33.4	1600	27.6	54.6	37.9	26.1	
		40.0	54.7	2200	50.8	47.5	70.1	63.1	
	65.2	27.8	57.5	0400	53.0	35.1	57.8	84.1	
OBLIQUE	2200	1600	1000		1000	1600	2200	0400	SURFACE
				0400	51.2	35.7	59.5		
				2200	66.5	50.5			
				1600	33.0				
				SURFACE					

Table 4.2-21

Percentage of ichthyoplankton drifting through Transect TM-LF-13A3 at night which were entrained by TMINS Unit 1, 27 April through 11 August 1977.

RIVER Date	Time (h)	Zone I		Zone II		Zone III		Zone IV		% Entrained
		N_I	F_I	N_{II}	F_{II}	N_{III}	F_{III}	N_{IV}	F_{IV}	
26 Apr	2158-2207	4.21	60.34	5.12	768.74	3.01	598.00	0.00	19.82	0.3
10 May	2206-2220	13.65	24.66	10.92	314.16	6.65	244.38	5.10	8.10	1.3
24-25 May	2247-0002	664.61	10.95	411.26	139.47	107.10	108.49	56.29	3.60	0.5
15 Jun	2010-2251	55.66	7.72	36.76	98.34	25.11	76.50	32.36	2.54	1.5
29 Jun	2133-2321	17.13	9.42	13.06	120.02	7.71	93.36	6.43	3.09	4.0
13 Jul	2322-2331	12.89	13.44	10.46	171.18	6.26	133.17	4.49	4.41	1.6
26 Jul	2207-2250	8.44	13.04	7.72	166.08	3.50	129.20	0.00	4.28	7.0
9-10 Aug	2241-0032	3.52	6.69	4.69	85.27	5.15	66.33	4.43	2.20	6.7
INTAKE			N_i		F_i					
27-28 Apr	2202-0615		15.67		1.03					
11-12 May	2155-0405		70.42		1.03					
25-26 May	2200-0342		379.67		1.00					
16-17 Jun	2204-0346		74.50		1.23					
29-30 Jun	2216-0345		84.92		1.15					
13-14 Jul	2211-0415		44.25		1.00					
25-26 Jul	2203-0345		128.92		1.00					
10-11 Aug	2208-0345		42.42		1.23					

N_I Mean density (n/100m^3) of ichthyoplankton in Zone I.
F_I Flow rate in Zone I (100m^3/min).
N_{II} Mean density (n/100m^3) of ichthyoplankton in Zone II.
F_{II} Flow rate in Zone II (100m^3/min).
N_{III} Mean density (n/100m^3) of ichthyoplankton in Zone III.
F_{III} Flow rate in Zone III (100m^3/min).
N_{IV} Mean density (n/100m^3) of ichthyoplankton in Zone IV.
F_{IV} Flow rate in Zone IV (100m^3/min).
N_i Mean density (n/100m^3) of ichthyoplankton in the TMINS Unit 1 Intake pump suction bay.
F_i Flow rate into TMINS Unit 1 Intake (100m^3/min).

Table 4.2-22

Percentage of ichthyoplankton drifting through Transect TM-LF-13A3 at night which were entrained by TMINS Unit 1, 28 April through 12 August 1976.

RIVER Date	Time (h)	Zone I N_I	Zone I F_I	Zone II N_{II}	Zone II F_{II}	Zone III N_{III}	Zone III F_{III}	Zone IV N_{IV}	Zone IV F_{IV}	% Entrained
28-29 Apr	2233-0032	26.41	6.17	18.77	78.70	5.56	61.23	-	2.02	4.3
12 May	2145-2202	173.53	4.17	109.25	53.19	30.03	41.38	15.09	1.37	13.6
27-28 May	2306-0002	223.18	7.39	139.78	94.30	75.37	73.37	94.35	2.42	1.7
9 Jun	2204-2234	380.88	10.22	236.77	130.35	61.31	101.42	29.96	3.35	1.5
24 Jun	2157-2232	18.91	16.14	14.07	205.86	8.36	160.18	7.48	5.29	8.5
14 Jul	2146-2222	35.56	6.21	24.40	79.21	12.73	61.63	12.22	2.04	2.7
28 Jul	2306-2345	43.92	2.68	29.54	34.18	14.01	26.60	12.86	0.88	4.1
11 Aug	2127-2204	13.19	8.91	10.64	113.65	4.54	88.43	1.00	2.92	3.1

INTAKE		N_i	F_i
28-29 Apr	2217-0354	79.13	1.08
12-13 May	2157-0349	794.82	1.33
26-27 May	2212-0415	347.40	1.03
9-10 Jun	2222-0404	481.08	1.30
24-25 Jun	2200-0403	391.05	1.00
14-15 Jul	2230-0427	63.92	1.23
28-29 Jul	2227-0443	50.02	1.23
11-12 Aug	2200-0358	44.12	1.23

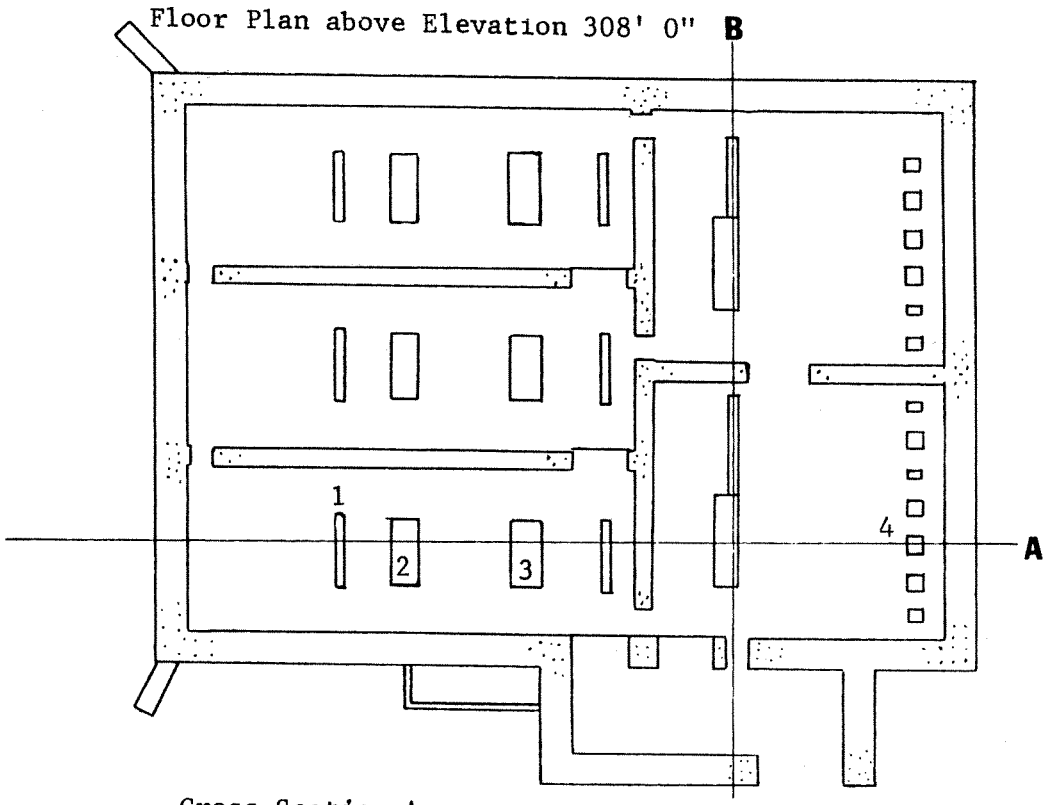
N_I Mean density (n/100m^3) of ichthyoplankton in Zone I.
F_I Flow rate in Zone I (100m^3/min).
N_{II} Mean density (n/100m^3) of ichthyoplankton in Zone II.
F_{II} Flow rate in Zone II (100m^3/min).
N_{III} Mean density (n/100m^3) of ichthyoplankton in Zone III.
F_{III} Flow rate in Zone III (100m^3/min).
N_{IV} Mean density (n/100m^3) of ichthyoplankton in Zone IV.
F_{IV} Flow rate in Zone IV (100m^3/min).
N_i Mean density (n/100m^3) of ichthyoplankton in the TMINS Unit 1 Intake pump suction bay.
F_i Flow rate into TMINS Unit 1 Intake (100m^3/min).

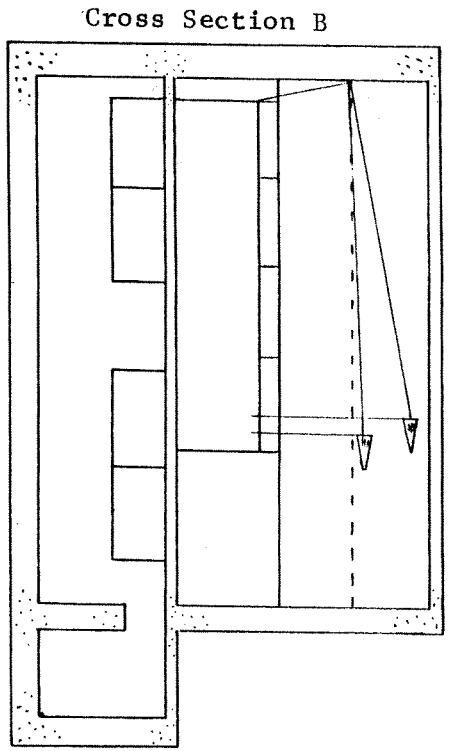
Table 4.2-23

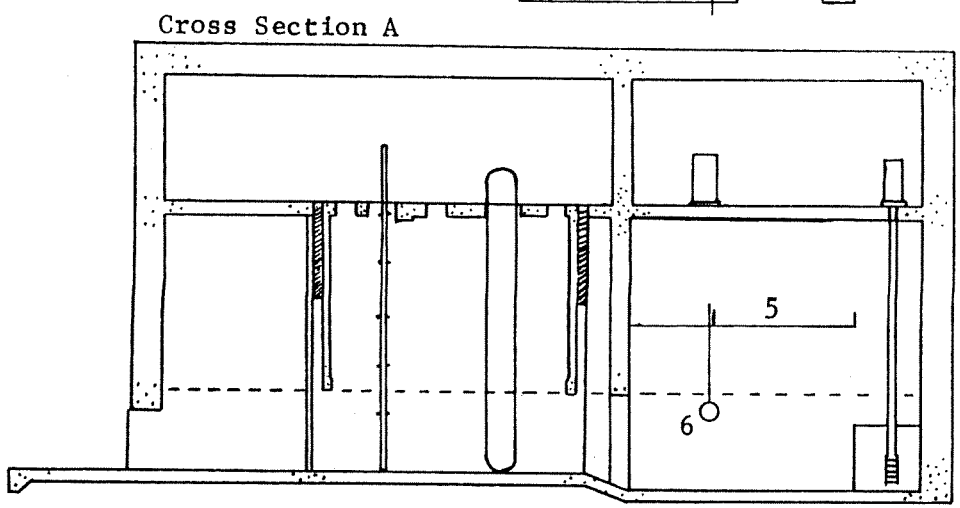
Estimated number of ichthyoplankton entrained during the 1000, 1600, 2200, and 0400 h sample periods (n/6 h x 10-3) April through August 1976 and 1977.

	1976								
	Apr 28-29	May 12-13	May 26-27	Jun 9-10	Jun 24-25	Jul 14-15	Jul 28-29	Aug 11-12	TOTAL
1000	100.64	567.72	120.39	754.66	425.82	51.37	40.26	11.65	2072.51
1600	21.63	323.62	238.78	206.25	181.71	67.64	37.26	11.65	1088.54
2200	42.62	311.78	221.76	209.34	96.90	100.58	37.96	-	1020.92
0400	80.45	1210.47	293.52	691.25	466.23	12.66	50.65	78.15	2883.37
TOTAL	245.33	2413.59	874.45	1861.50	1170.66	232.25	166.12	101.45	7065.35

	1977								
	Apr 27-28	May 11-12	May 25-26	Jun 16-17	Jun 29-30	Jul 13-14	Jul 25-26	Aug 10-11	TOTAL
1000	11.11	13.77	655.48	54.41	266.89	-	57.75	69.13	1128.54
1600	10.80	106.60	350.15	27.13	14.40	-	-	-	509.09
2200	-	87.88	244.08	67.39	15.89	28.95	23.23	26.33	493.75
0400	24.30	43.88	346.51	69.81	140.78	34.84	162.29	51.96	874.37
TOTAL	46.21	252.13	1596.22	218.74	437.96	63.79	243.27	147.42	3005.74







1 Stop log
2 Course Trash Bars
3 Traveling Screens
4 River Water Pumps
5 Pump Suction Bay
6 0.5 m Plankton Net
------ Normal River Elevation 278' 0"

Figure 4.1-1. Three Mile Island Nuclear Station Unit 1 Intake.

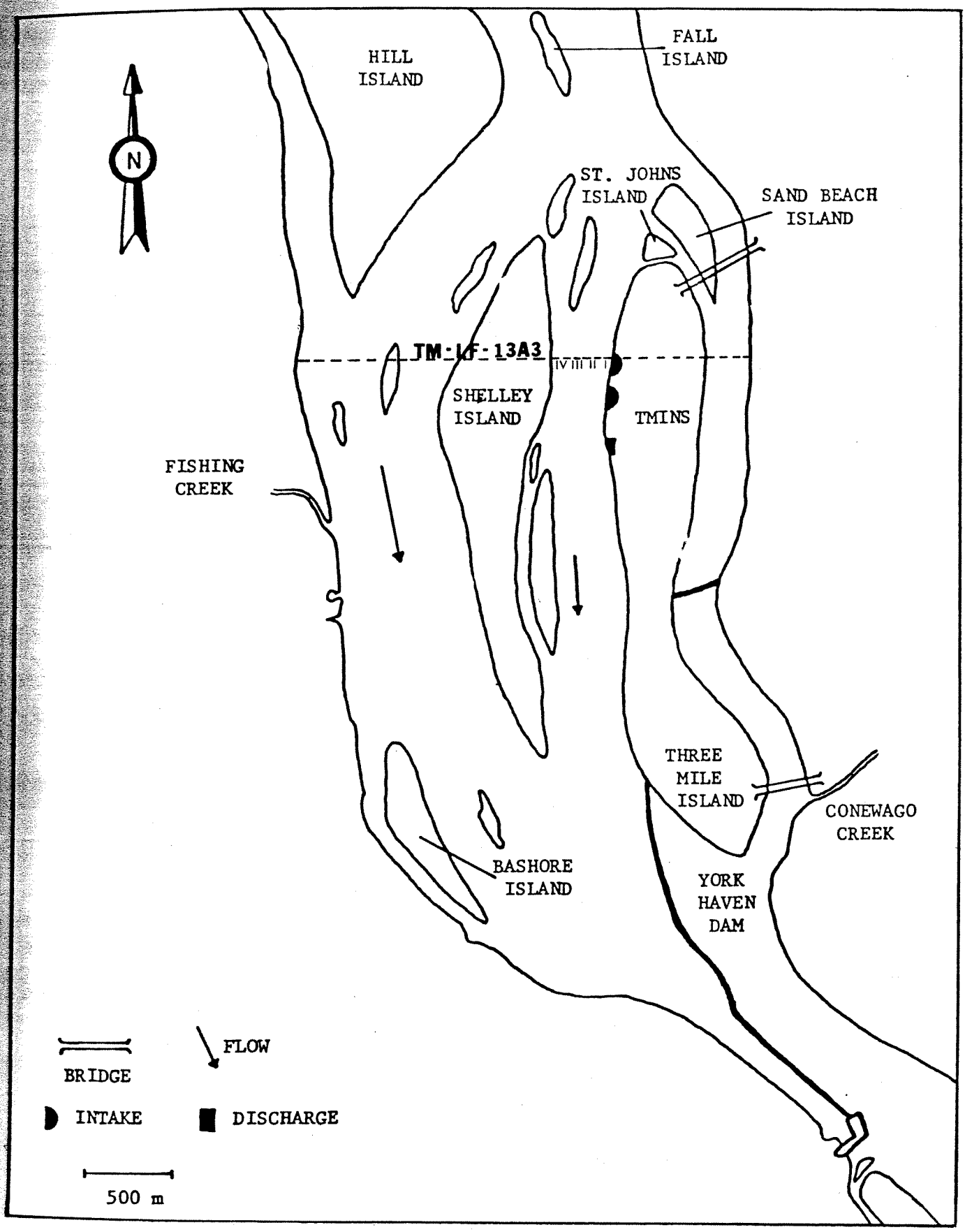


Figure 4.1-2 . Location of ichthyoplankton zones I through IV of Transect TM-LF-13A3 in the center channel of York Haven Pond.

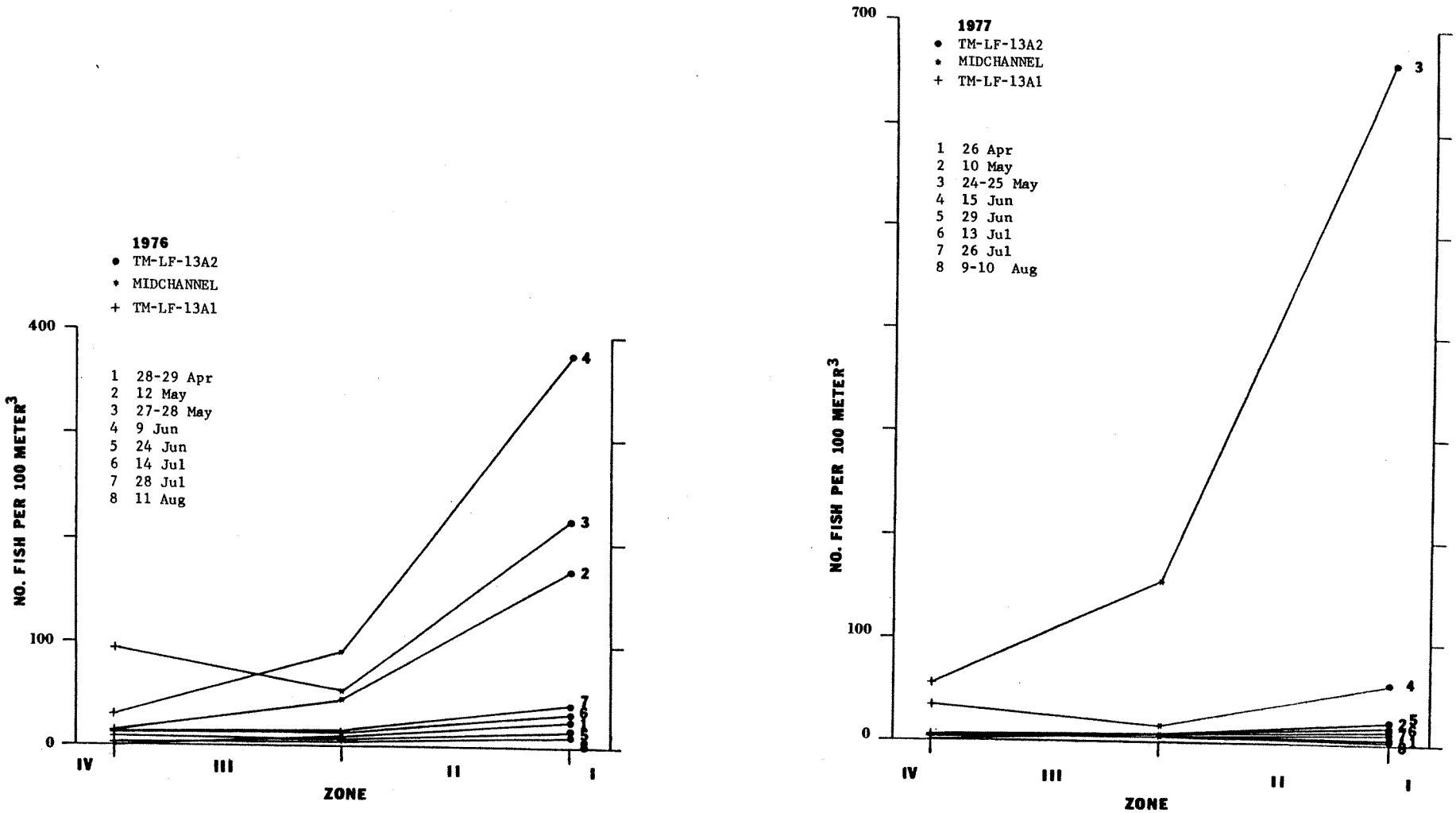


Figure 4.2-1. Distribution of ichthyoplankton in Transect TM-LF-13A3 in the center channel of York Haven Pond off the TMINS Unit 1 Intake, 1976 and 1977.

5.0 IMPINGEMENT OF FISH

Impingement surveys at the TMINS Unit 1 Intake were conducted semi-monthly at 8-hour intervals March through December 1977. Mechanical problems prevented sampling in January and February and limited sampling to once in August.

The Unit 1 Intake is enclosed in a concrete building on the west shore of Three Mile Island, and is flush with the shoreline. River water passes under the skimmer wall, which has trash bars with two foot vertical spacing; through automated trash racks, with one inch vertical bar spacing; and through vertical traveling screens of 3/8 inch mesh before entering the river water pumps. The average water velocity before the traveling screens under normal (20,000 cfs) and low (1,700cfs) river flows and normal (full power, 100%) operating conditions is 0.2 foot/second (A.E.C. 1972).

Fish and refuse from the automated trash racks and vertical traveling screens are washed into separate trash bins. The bin for the traveling screens also receives the discharge from all river water pump automatic discharge strainers of 1/8 inch mesh.

5.1 METHODS

Fish impinged on the traveling screens were recorded during each 24-hour survey. A section of 6.4 mm mesh seine was placed in the traveling screen trash bin to capture fish.

Impinged fish were enumerated and identified to the lowest feasible taxon. Each fish was measured (to the nearest mm fork length, FL) and weighed (to the nearest 0.1 g) for each 8-hour interval. Fish were classified as alive (opercular movement observed) or dead (no opercular

movement). The reproductive status was determined and defined as follows: young were spawned during the current calendar year; juveniles were incapable of reproduction; and adults were capable of reproduction. Classifications were based on field observations and information in the literature (Carlander 1953, 1969, 1977; Miller and Buss 1963; Scott and Crossman 1973; Trautman 1957).

Estimates of the total number and biomass of fish impinged at TMINS in 1977 were made from the formula (Potter and Associates 1976):

$$T = (\bar{X})\ (365)$$

where T = estimate of number or biomass and

$\bar{X}$ = mean number or biomass of fish impinged per survey.

Estimates for 1974 through 1977 were made. A one-way analysis of variance (random effects model) was used to test for differences between years for numbers of fish impinged on the TMINS Unit 1 traveling screens (Steel and Torrie 1960).

5.2 RESULTS

Twenty impingement surveys were conducted. Alive and dead totals for fishes taken during each 8-hour interval and summaries of each 24-hour survey are presented in Tables 5.2-1 through 5.2-40.

A total of 3,359 fish of 24 species weighing 2.45 kg (5.40 lb) was impinged in 1977 (Table 5.2-41). Most fish (3,180 specimens, 94.7 %) were dead and were either young or juvenile.

Three species accounted for 88.3 % of the impinged fish: the

tessellated darter (72.5 %), banded darter (10.4 %), and spottail shiner (5.4 %) Table 5.2-41. Each of the remaining species represented less than 2.0 % of the total number collected.

Numbers of fish impinged per 24-hour survey varied throughout the year (Table 5.2-41). The greatest number impinged per 24- hour survey was 1,782 taken on 22-23 September; The tessellated darter (1,526) and banded darter (197) were most common (Table 5.2-26). The greatest weight of fish impinged was 1,101.7 g (2.4 lb) on 22-23 September.

The mean number of fish impinged per survey was 168.0; mean biomass was 122.6 g. The mean weight per fish was 0.7 g. Frequency of impingement during day and night throughout the year was variable.

The 1977 yearly estimate of number of fish impinged was 61,320; the estimated biomass was 44.7 kg (98.6 lb). The analysis of variance revealed no significant differences ($P > 0.05$) between years for the numbers of fish impinged at TMINS Unit 1 (Table 5.2-42).

5.3 DISCUSSION

The number and biomass of fish impinged in 1977 was the highest since the inception of the program (1974). Impingement frequency appeared to be affected by both river flow and the availability of young fishes. About 76 % (2,563 fish) of the total fish impinged were taken on two dates in September 1977.

The tessellated darter was most abundant in all years; the spottail shiner was also common. In 1977, the channel catfish decreased in abundance and the banded darter increased in abundance

making up more than 4.0 % of the catch of the first time.

In comparison to the number and biomass of fish taken by seine (Section 6.2) the number and biomass impinged was small. Although the numbers of fish impinged in 1977 was the highest to date the overall impact to the river ecosystem was negligible.

LITERATURE CITED

A.E.C. 1972. Final environmental statement related to the operation of Three Mile Island Nuclear Station. United States Atomic Energy Commission. Washington, D.C. pp. III-8 - III-10.

Carlander, K.D. 1953. Handbook of freshwater fishery biology with the first supplement. Wm. C. Brown Co. Dubuque, Iowa. 430 pp.

_____. 1969. Handbook of freshwater fishery biology. Vol. 1. Life history data on freshwater fishes of the United States and Canada, exclusive of the Perciformes. Iowa State University Press. Ames, Iowa. 752 pp.

_____. 1977. Handbook of freshwater fishery biology. Vol. 2. Life history data on centrarchid fishes of the United States and Canada. Iowa State University Press. Ames, Iowa. 431 pp.

Miller, J. and K. Buss. 1963? . The age and growth of the fishes in Pennsylvania. Pa. Fish Comm. 26 pp.

Potter, W.A. and Associates. 1976. An ecological study of the Susquehanna River in the vicinity of the Three Mile Island Nuclear Station. Annual Report for 1975. Ichthyological Associates, Inc. 395 pp.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fish. Res. Bd. Can. Bull. 184. 966 pp.

Steel, R.G.D. and J.H. Torrie. 1960. Principles and procedures of statistics. McGraw-Hill Book Company, Inc. New York. 481 pp.

Trautman, M.B. 1957. The fishes of Ohio with illustrated keys. Ohio State University Press. Columbus, Ohio. 683 pp.

Table 5.2-1

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 18-19 March 1977.

Date	18		19		19			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	0		0		1			
River Flow (cfs)	130,000		120,000		117,000		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	-	-	-	3	-	1	-	4
Channel catfish	2	-	-	1	1	-	3	1
Margined madtom	-	-	-	1	-	-	-	1
Redbreast sunfish	-	-	-	-	-	1	-	1
Pumpkinseed	-	-	-	-	1	-	1	-
Tessellated darter	6	5	1	32	10	9	17	46
Banded darter	-	-	-	3	-	-	-	3
Total	8	5	1	40	12	11	21	56

Table 5.2-2

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 18-19 March 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	46-50, 66-70	1 Juvenile, 3 Adults	11.1	4
Channel catfish	56-70	4 Juveniles	11.5	4
Margined madtom	51-55	1 Juvenile	1.4	1
Redbreast sunfish	41-45	1 Juvenile	1.5	1
Pumpkinseed	51-55	1 Juvenile	2.7	1
Tessellated darter	31-70	18 Juveniles, 45 Adults	66.9	63
Banded darter	31-40	3 Juveniles	1.7	3
			96.8	77

Table 5.2-3

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 30-31 March 1977.

Date	30		31		31			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	1		1		1			
Decay Heat	2		2		2			
River Flow (cfs)	116,200		146,600		148,000		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	-	-	-	1	-	2	-	3
Channel catfish	-	-	-	-	1	-	1	-
Margined madtom	1	-	2	1	-	-	3	1
Tessellated darter	1	-	2	9	12	13	15	22
Total	2	-	4	11	13	15	19	26

Table 5.2-4

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 30-31 March 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	51-55, 66-75	1 Juvenile, 2 Adults	9.6	3
Channel catfish	61-65	1 Juvenile	2.5	1
Margined madtom	36-40, 106-115	2 Juveniles, 2 Adults	20.0	4
Tessellated darter	41-65	4 Juveniles, 33 Adults	36.9	37
			69.0	45

Table 5.2-5

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 20-21 April 1977.

Date	20		21		21			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	1		1		1			
Decay Heat	1		1		1			
River Flow (cfs)	27,800		26,900		26,500		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	1	-	-	-	-	-	1	-
Margined madtom	-	-	-	-	-	1	-	1
Rock bass	1	-	-	-	-	-	1	-
Tessellated darter	-	-	1	-	-	-	1	-
Total	2	-	1	-	-	1	3	1

Table 5.2-6

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 20-21 April 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	81-85	1 Adult	6.1	1
Margined madtom	36-40	1 Juvenile	0.8	1
Rock bass	36-40	1 Juvenile	1.0	1
Tessellated darter	51-55	1 Adult	1.1	1
			9.0	4

Table 5.2-7

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 21-22 April 1977.

Date	21		22		22			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		1		1			
Decay Heat	2		2		2			
River Flow (cfs)	26,300		25,700		25,000		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Margined madtom	-	-	1	-	-	-	1	-
Tessellated darter	1	-	-	-	1	-	2	-
Total	1	-	1	-	1	-	3	-

Table 5.2-8

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 21-22 April 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Margined madtom	51-55	1 Juvenile	1.0	1
Tessellated darter	56-65	2 Adults	4.0	2
			5.0	3

Table 5.2-9

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 12-13 May 1977.

Date	12		13		13			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	1		1		1			
Decay Heat	1		1		1			
River Flow (cfs)	33,000		34,600		35,500		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Tessellated darter	-	-	1	-	-	-	1	-
Total	-	-	1	-	-	-	1	-

Table 5.2-10

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 12-13 May 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Tessellated darter	46-50	1 Adult	0.9	1
			0.9	1

Table 5.2-11

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 26-27 May 1977.

Date	26		27		27			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	3		3		3			
Secondary Service	2		2		2			
Decay Heat	0		0		0			
Reactor Building Emergency Cooling	1		1		0			
River Flow (cfs)	14,300		14,200		14,000		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spotfin shiner	-	1	-	-	-	-	-	1
Margined madtom	1	-	-	-	-	-	1	-
Bluegill	-	-	-	1	-	-	-	1
Total	1	1	-	1	-	-	1	2

Table 5.2-12

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 26-27 May 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spotfin shiner	61-65	1 Adult	4.1	1
Margined madtom	66-70	1 Juvenile	3.2	1
Bluegill	41-45	1 Juvenile	2.0	1
			9.3	3

Table 5.2-13

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 9-10 June 1977.

Date	9		10		10			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	3		3		3			
Secondary Service	2		2		2			
Decay Heat	0		0		0			
River Flow (cfs)	9,000		10,500		11,300		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Carp	-	-	-	4	-	3	-	7
Channel catfish	-	-	-	1	-	-	-	1
Tessellated darter	1	2	1	-	-	-	2	2
Banded darter	-	-	-	1	-	-	-	1
Total	1	2	1	6	-	3	2	11

Table 5.2-14

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 9-10 June 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Carp	16-30	7 Young	1.6	7
Channel catfish	146-150	1 Juvenile	28.8	1
Tessellated darter	21-30	1 Young, 3 Juveniles	0.5	4
Banded darter	16-20	1 Young	0.1	1
			31.0	13

Table 5.2-15

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 20-21 June 1977.

Date	20		21		21			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	3		3		3			
Secondary Service	2		2		2			
Decay Heat	0		0		0			
River Flow (cfs)	10,100		10,200		10,200		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Carp	-	2	-	4	-	1	-	7
Spotfin shiner	-	-	-	-	-	2	-	2
White sucker	-	-	-	1	-	-	-	1
Rock bass	-	-	-	-	-	1	-	1
Smallmouth bass	-	1	1	1	-	2	1	4
Tessellated darter	-	-	-	1	2	-	2	1
Banded darter	-	-	-	-	-	1	-	1
Walleye	1	-	-	-	-	-	1	-
Total	1	3	1	7	2	7	4	17

Table 5.2-16

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 20-21 June 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Carp	21-40	7 Young	4.3	7
Spotfin shiner	26-30, 56-60	1 Young, 1 Juvenile	2.3	2
White sucker	36-40	1 Young	0.4	1
Rock bass	16-20	1 Young	0.1	1
Smallmouth bass	16-35	5 Young	1.3	5
Tessellated darter	21-25, 31-35	2 Young, 1 Juvenile	0.4	3
Banded darter	26-30	1 Young	0.2	1
Walleye	71-75	1 Young	4.0	1
			13.0	21

Table 5.2-17

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 6-7 July 1977.

Date	6		7		7			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	1		1		1			
River Flow (cfs)	8,700		8,700		8,900		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Carp	1	-	-	3	-	-	1	3
Spottail shiner	-	7	-	14	-	17	-	38
Quillback	-	-	-	1	-	-	-	1
White sucker	-	-	-	1	-	-	-	1
Brown bullhead	-	2	-	-	-	3	-	5
Channel catfish	-	2	-	1	-	1	-	4
Margined madtom	-	6	-	1	-	-	-	7
Rock bass	-	5	1	-	-	5	1	10
Pumpkinseed	-	1	-	1	-	3	-	5
Bluegill	-	8	-	7	-	10	-	25
Smallmouth bass	-	2	-	1	-	1	-	4
White crappie	-	1	-	4	-	-	-	5
Tessellated darter	-	15	-	20	-	31	-	66
Shield darter	-	1	-	4	-	-	-	5
Total	1	50	1	58	-	71	2	179

Table 5.2-18

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 6-7 July 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Carp	31-40, 61-65	4 Young	8.6	4
Spottail shiner	21-40, 66-70	33 Young, 4 Juveniles, 1 Adult	12.8	38
Quillback	41-45	1 Young	1.1	1
White sucker	46-50	1 Young	1.1	1
Brown bullhead	31-35, 41-55	5 Young	6.9	5
Channel catfish	16-25, 31-40	4 Young	0.9	4
Margined madtom	31-40	7 Young	2.3	7
Rock bass	16-20, 26-40	11 Young	8.3	11
Pumpkinseed	26-35	5 Young	2.9	5
Bluegill	16-40	25 Young	5.8	25
Smallmouth bass	31-40, 51-55, 61-65	4 Young	6.0	4
White crappie	21-35	5 Young	1.1	5
Tessellated darter	21-45, 66-70	43 Young, 22 Juveniles, 1 Adult	18.8	66
Shield darter	26-40	5 Young	1.8	5
			78.4	181

Table 5.2-19

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 12-13 July 1977.

Date	12		13		13			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	1		1		0			
River Flow (cfs)	19,200		16,800		16,200		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Carp	-	-	1	3	1	-	2	3
Spottail shiner	1	14	1	42	-	19	2	75
Spotfin shiner	-	-	-	2	-	-	-	2
White sucker	-	-	-	1	-	1	-	2
Northern hog sucker	-	-	-	1	-	-	-	1
Shorthead redhorse	-	-	-	3	-	2	-	5
Brown bullhead	1	1	-	4	-	3	1	8
Channel catfish	-	-	-	4	-	1	-	5
Margined madtom	2	-	-	4	-	-	2	4
Rock bass	-	4	-	4	-	2	-	10
Pumpkinseed	-	6	-	7	-	5	-	18
Bluegill	-	3	-	6	-	13	-	22
Smallmouth bass	1	-	-	1	-	-	1	1
Tessellated darter	2	27	-	47	1	23	3	97
Banded darter	-	-	-	4	-	1	-	5
Shield darter	-	2	-	3	-	2	-	7
Total	7	57	2	136	2	72	11	265

Table 5.2-20

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 12-13 July 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Carp	36-40, 46-50, 56-60	5 Young	16.2	5
Spottail shiner	21-40	63 Young, 14 Juveniles	22.6	77
Spotfin shiner	26-35	2 Young	0.2	2
White sucker	31-35, 46-50	2 Young	1.4	2
Northern hog sucker	41-45	1 Young	0.8	1
Shorthead redhorse	31-45	5 Young	2.3	5
Brown bullhead	26-30, 36-55	9 Young	6.7	9
Channel catfish	21-25, 31-45	5 Young	1.8	5
Margined madtom	26-30, 36-40, 81-85	4 Young, 2 Juveniles	11.4	6
Rock bass	16-20, 26-40	10 Young	6.4	10
Pumpkinseed	21-35	18 Young	5.8	18
Bluegill	21-35	22 Young	5.7	22
Smallmouth bass	36-40, 46-50	2 Young	2.8	2
Tessellated darter	26-45	68 Young, 32 Juveniles	29.5	100
Banded darter	26-35	5 Young	1.1	5
Shield darter	26-45	6 Young, 1 Juvenile	2.1	7
			116.8	276

Table 5.2-21

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 16-17 August 1977.

Date	16		17		17			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	3		3		3			
Secondary Service	2		2		2			
Decay Heat	0		0		0			
River Flow (cfs)	10,900		11,800		12,400		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	-	-	-	1	-	2	-	3
Northern hog sucker	-	-	-	1	-	-	-	1
Yellow bullhead	-	1	-	1	-	-	-	2
Brown bullhead	-	-	-	1	-	-	-	1
Channel catfish	-	3	2	5	-	4	2	12
Rock bass	-	-	-	-	1	-	1	-
Pumpkinseed	-	-	-	3	-	1	-	4
White crappie	-	-	1	-	-	-	1	-
Tessellated darter	-	1	-	-	-	3	-	4
Total	-	5	3	12	1	10	4	27

Table 5.2-22

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 16-17 August 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	31-35, 41-45	1 Young, 2 Juveniles	1.9	3
Northern hog sucker	56-60	1 Young	2.0	1
Yellow bullhead	51-60	2 Young	4.7	2
Brown bullhead	56-60	1 Young	2.3	1
Channel catfish	36-65, 76-80	14 Young	29.2	14
Rock bass	56-60	1 Juvenile	3.5	1
Pumpkinseed	46-50	4 Young	8.8	4
White crappie	51-55	1 Young	1.9	1
Tessellated darter	26-35, 41-45	4 Young	1.2	4
			55.5	31

Table 5.2-23

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 8-9 September 1977.

Date	8		9		9			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	1		0		0			
River Flow (cfs)	6,400		6,700		6,540		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Bluntnose minnow	-	-	-	1	-	-	-	1
Channel catfish	-	-	-	-	-	1	-	1
Redbreast sunfish	-	-	1	-	-	-	1	-
Pumpkinseed	-	-	-	1	-	1	-	2
Bluegill	-	-	1	-	-	-	1	-
Black crappie	-	-	-	-	-	1	-	1
Tessellated darter	-	-	-	-	1	1	1	1
Banded darter	-	-	1	-	-	-	1	-
Total	-	-	3	2	1	4	4	6

Table 5.2-24

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 8-9 September 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Bluntnose minnow	46-50	1 Juvenile	1.5	1
Channel catfish	76-80	1 Young	5.3	1
Redbreast sunfish	101-105	1 Adult	20.4	1
Pumpkinseed	36-40, 56-60	2 Young	4.6	2
Bluegill	36-40	1 Young	1.6	1
Black crappie	91-95	1 Juvenile	15.5	1
Tessellated darter	36-45	2 Juveniles	1.3	2
Banded darter	31-35	1 Young	0.3	1
			50.5	10

Table 5.2-25

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 22-23 September 1977.

Date	22		23		23			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	0		0		0			
River Flow (cfs)	65,100		69,700		69,700		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	-	3	-	7	-	4	-	14
Swallowtail shiner	-	-	-	-	-	1	-	1
Bluntnose minnow	-	-	-	-	-	1	-	1
Yellow bullhead	1	-	-	1	-	-	1	1
Channel catfish	-	-	-	-	-	3	-	3
Margined madtom	-	-	1	1	-	1	1	2
Rock bass	1	-	-	1	1	2	2	3
Redbreast sunfish	2	1	-	1	-	1	2	3
Pumpkinseed	6	1	-	6	1	2	7	9
Bluegill	-	2	-	-	-	-	-	2
Black crappie	-	-	-	-	1	-	1	-
Tessellated darter	5	303	2	669	7	540	14	1512
Banded darter	2	37	2	108	-	48	4	193
Shield darter	-	2	-	1	-	3	-	6
Total	17	349	5	795	10	606	32	1750

Table 5.2-26

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 22-23 September 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	21-25, 31-65	2 Young, 11 Juveniles, 1 Adult	19.2	14
Swallowtail shiner	36-40	1 Juvenile	0.4	1
Bluntnose minnow	46-50	1 Juvenile	1.1	1
Yellow bullhead	76-80, 101-105	2 Juveniles	20.7	2
Channel catfish	66-70	3 Young	13.5	3
Margined madtom	46-50, 91-95, 101-105	1 Young, 1 Juvenile, 1 Adult	18.9	3
Rock bass	46-55, 61-70	1 Young, 4 Juveniles	22.8	5
Redbreast sunfish	31-35, 41-55	3 Young, 2 Juveniles	12.5	5
Pumpkinseed	41-65	16 Young	44.6	16
Bluegill	41-45	2 Young	3.7	2
Black crappie	116-120	1 Juvenile	27.9	1
Tessellated darter	21-65	651 Young, 834 Juveniles, 41 Adults	811.9	1526
Banded darter	26-50	131 Young, 65 Juveniles, 1 Adult	100.4	197
Shield darter	31-50	1 Young, 4 Juveniles, 1 Adult	4.1	6
			1101.7	1782

Table 5.2-27

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 26-27 September 1977.

Date	26		27		27			
Time	1200-2000		2000-0400		0400-1200			
Prevoius River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	1		1		1			
River Flow (cfs)	75,200		138,000		150,000		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	-	5	-	5	-	9	-	19
Spotfin shiner	-	-	-	2	-	2	-	4
Northern hog sucker	-	-	-	-	-	1	-	1
Channel catfish	1	-	-	-	-	-	1	-
Margined madtom	2	-	-	1	2	1	4	2
Rock bass	1	3	-	-	1	-	2	3
Redbreast sunfish	-	-	1	-	2	-	3	-
Pumpkinseed	1	3	-	4	1	4	2	11
Bluegill	1	-	-	2	-	2	1	4
Smallmouth bass	-	1	-	-	1	-	1	1
Tessellated darter	3	62	9	124	3	360	15	546
Banded darter	-	11	1	37	1	87	2	135
Shield darter	-	1	-	5	-	18	-	24
Total	9	86	11	180	11	484	31	750

Table 5.2-28

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 26-27 September 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	21-30, 36-65	2 Young, 15 Juveniles, 2 Adults	22.1	19
Spotfin shiner	36-45	4 Juveniles	1.8	4
Northern hog sucker	81-85	1 Young	6.7	1
Channel catfish	56-60	1 Young	2.8	1
Margined madtom	36-40, 86-90, 96-110, 131-135	1 Young, 2 Juveniles, 3 Adults	53.0	6
Rock bass	46-60	1 Young, 4 Juveniles	17.0	5
Redbreast sunfish	41-50	3 Young	6.3	3
Pumpkinseed	36-65	13 Young	33.0	13
Bluegill	41-45, 51-60	5 Young	12.9	5
Smallmouth bass	71-75, 91-95	2 Young	17.5	2
Tessellated darter	26-70	126 Young, 395 Juveniles, 40 Adults	276.1	561
Banded darter	26-50	84 Young, 52 Juveniles, 1 Adult	55.3	137
Shield darter	31-35	1 Young, 17 Juveniles, 6 Adults	16.2	24
			520.3	781

Table 5.2-29

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 6-7 October 1977.

Date	6		7		7			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	1		1		1			
River Flow (cfs)	48,200		44,800		43,500		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	1	6	1	6	1	3	3	15
Margined madtom	-	-	1	-	-	-	1	-
Rock bass	1	-	1	-	1	1	3	1
Redbreast sunfish	-	-	-	1	-	-	-	1
Pumpkinseed	-	-	-	1	1	-	1	1
Bluegill	-	-	-	-	1	-	1	-
Smallmouth bass	1	-	-	-	2	-	3	-
Tessellated darter	-	13	1	8	7	9	8	30
Banded darter	-	3	-	2	-	-	-	5
Total	3	22	4	18	13	13	20	53

Table 5.2-30

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 6-7 October 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	21-25, 46-70	1 Young, 14 Juveniles, 3 Adults	32.6	18
Margined madtom	61-65	1 Juvenile	2.8	1
Rock bass	41-45, 51-60, 66-70	4 Juveniles	12.6	4
Redbreast sunfish	46-50	1 Young	2.0	1
Pumpkinseed	56-60, 71-75	2 Young	12.4	2
Bluegill	41-45	1 Young	1.5	1
Smallmouth bass	86-95	3 Young	28.9	3
Tessellated darter	31-60	2 Young, 27 Juveniles, 9 Adults	27.4	38
Banded darter	36-50	4 Juveniles, 1 Adult	3.3	5
			123.5	73

Table 5.2-31

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 27-28 October 1977.

Date	27		28		28			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	1		1		1			
River Flow (cfs)	49,600		47,500		46,900		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spotfin shiner	-	-	-	1	-	-	-	1
Bluntnose minnow	-	-	-	-	-	2	-	2
Shorthead redhorse	-	-	-	-	-	1	-	1
Channel catfish	2	-	-	-	-	1	2	1
Rock bass	2	1	-	-	-	1	2	2
Pumpkinseed	-	2	-	-	1	-	1	2
Smallmouth bass	-	-	1	-	-	-	1	-
Tessellated darter	1	5	1	3	-	3	2	11
Total	5	8	2	4	1	8	8	20

Table 5.2-32

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 27-28 October 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spotfin shiner	26-30	1 Young	0.2	1
Bluntnose minnow	26-35	2 Young	0.5	2
Shorthead redhorse	96-100	1 Young	12.9	1
Channel catfish	36-40, 66-70, 76-80	3 Young	8.8	3
Rock bass	51-65	4 Juveniles	15.7	4
Pumpkinseed	46-50, 61-65	3 Young	13.3	3
Smallmouth bass	101-105	1 Young	15.0	1
Tessellated darter	36-40, 46-55	3 Juveniles, 10 Adults	9.7	13
			76.1	28

Table 5.2-33

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 15-16 November 1977.

Date	15		16		16			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	2		2		2			
River Flow (cfs)	89,300		78,600		74,600		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	1	1	-	-	-	2	1	3
Shorthead redhorse	1	-	-	-	-	-	1	-
Channel catfish	1	1	2	1	-	-	3	2
Rock bass	-	-	1	-	-	-	1	-
Pumpkinseed	-	-	-	-	1	-	1	-
Smallmouth bass	1	-	-	-	1	-	2	-
Tessellated darter	-	3	1	2	-	1	1	6
Total	4	5	4	3	2	3	10	11

Table 5.2-34

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 15-16 November 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	41-45, 51-55, 61-65	3 Juveniles, 1 Adult	7.3	4
Shorthead redhorse	106-110	1 Young	15.7	1
Channel catfish	51-65, 76-80	5 Young	15.4	5
Rock bass	61-65	1 Juvenile	4.9	1
Pumpkinseed	61-65	1 Young	5.2	1
Smallmouth bass	96-100, 111-115	2 Young	28.7	2
Tessellated darter	36-50	5 Juveniles, 2 Adults	5.5	7
			82.7	21

Table 5.2-35

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 22-23 November 1977.

Date	22		23		23			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Cholrination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	0		0		0			
River Flow (cfs)	46,200		44,500		44,200		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Spottail shiner	-	-	1	-	1	-	2	-
Tessellated darter	-	1	-	-	1	2	1	3
Total	-	1	1	-	2	2	3	3

Table 5.2-36

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 22-23 November 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Spottail shiner	56-60, 66-70	1 Juvenile, 1 Adult	5.1	2
Tessellated darter	36-45, 56-60	3 Juveniles, 1 Adult	3.7	4
			8.8	6

Table 5.2-37

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 6-7 December 1977.

Date	6		7		7			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	0		0		0			
River Flow (cfs)	75,600		70,600		65,800		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Channel catfish	-	-	-	-	-	1	-	1
Tessellated darter	-	-	-	-	-	1	-	1
Total	-	-	-	-	-	2	-	2

Table 5.2-38

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 6-7 December 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Channel catfish	46-50	1 Young	1.4	1
Tessellated darter	36-40	1 Juvenile	0.6	1
			2.0	2

Table 5.2-39

Numbers of fishes impinged at the Unit 1 Intake during a 24-hr impingement survey on 14-15 December 1977.

Date	14		15		15			
Time	1200-2000		2000-0400		0400-1200			
Previous River Water Chlorination	1700		0100		0900			
Number of River Water Pumps:								
Nuclear Service	2		2		2			
Secondary Service	2		2		2			
Decay Heat	1		1		2			
River Flow (cfs)	29,000		33,100		33,500		Total	
Condition of Fish	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Tessellated darter	-	1	-	-	-	-	-	1
Total	-	1	-	-	-	-	-	1

Table 5.2-40

Summary of lengths, weights, breeding condition, and numbers of fishes impinged at the Unit 1 Intake on 14-15 December 1977.

Species	Fork Length Range (5 mm groups)	Reproductive Status	Total Weight (g)	Total Number
Tessellated darter	41-45	1 Juvenile	0.9	1
			0.9	1

Table 5.2-41

Summary of impingement data taken during 24-hr surveys at the TMINS Unit 1 Intake, March through December 1977.

Date	Mar 18-19		Mar 30-31		Apr 20-21		Apr 21-22		May 12-13		May 26-27		Jun 9-10		Jun 20-21		Jul 6-7		Jul 12-13		Aug 16-17		Sep 8-9	
Condition	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead
Carp	-	-	-	-	-	-	-	-	-	-	-	-	-	7	-	7	1	3	2	3	-	-	-	-
Spottail shiner	-	4	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	38	2	75	-	3	-	-
Swallowtail shiner	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spotfin shiner	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2	-	-	-	2	-	-	-	-
Bluntnose minnow	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Quillback	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
White sucker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	2	-	-	-	-
Northern hog sucker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-
Shorthead redhorse	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-
Yellow bullhead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
Brown bullhead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	1	8	-	1	-	-	-	-
Channel catfish	3	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	4	-	5	2	12	-	1
Margined madtom	-	1	3	1	-	1	1	-	-	-	1	-	-	-	-	-	-	7	2	4	-	-	-	-
Rock bass	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1	1	10	-	10	1	-	-	-
Redbreast sunfish	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Pumpkinseed	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	18	-	4	-	2
Bluegill	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	25	-	22	-	-	1	-
Smallmouth bass	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4	-	4	1	1	-	-	-	-
White crappie	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	1	-	-	-
Black crappie	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Tessellated darter	17	46	15	22	1	-	2	-	1	-	-	-	2	2	2	1	-	66	3	97	-	4	1	1
Banded darter	-	3	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-	5	-	-	1	-
Shield darter	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	7	-	-	-	-
Walleye	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Subtotal	21	56	19	26	3	1	3	-	1	-	1	2	2	11	4	17	2	179	11	265	4	27	4	6
Total	77		45		4		3		1		3		13		21		181		276		31		10	
Total Weight (g)	96.8		69.0		9.0		5.0		0.9		9.3		31.0		13.0		78.4		116.8		55.5		50.5	

Table 5.2-41 continued.

Date	Sep 22-23		Sep 26-27		Oct 6-7		Oct 27-28		Nov 15-16		Nov 22-23		Dec 6-7		Dec 14-15		Subtotal		Total	Percent
Condition	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead	Alive	Dead		Composition
Carp	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	20	23	0.7
Spottail shiner	-	14	-	19	3	15	-	-	1	3	2	-	-	-	-	-	9	174	183	5.4
Swallowtail shiner	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	+
Spotfin shiner	-	-	-	4	-	-	-	1	-	-	-	-	-	-	-	-	-	10	10	0.3
Bluntnose minnow	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	4	4	0.1
Quillback	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	+
White sucker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4	0.1
Northern hog sucker	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3	0.1
Shorthead redhorse	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	1	6	7	0.2
Yellow bullhead	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3	4	0.1
Brown bullhead	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	14	15	0.4
Channel catfish	-	3	1	-	-	-	2	1	3	2	-	-	-	1	-	-	12	31	43	1.3
Margined madtom	1	2	4	2	1	-	-	-	-	-	-	-	-	-	-	-	13	18	31	0.9
Rock bass	2	3	2	3	3	1	2	2	1	-	-	-	-	-	-	-	13	30	43	1.3
Redbreast sunfish	2	3	3	-	-	1	-	-	-	-	-	-	-	-	-	-	6	5	11	0.3
Pumpkinseed	7	9	2	11	1	1	1	2	1	-	-	-	-	-	-	-	13	52	65	1.9
Bluegill	-	2	1	4	1	-	-	-	-	-	-	-	-	-	-	-	3	54	57	1.7
Smallmouth bass	-	-	1	1	3	-	1	-	2	-	-	-	-	-	-	-	9	10	19	0.6
White crappie	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	6	0.2
Black crappie	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	2	0.1
Tessellated darter	14	1512	15	546	8	30	2	11	1	6	1	3	-	1	-	1	85	2349	2434	72.5
Banded darter	4	193	2	135	-	5	-	-	-	-	-	-	-	-	-	-	7	343	350	10.4
Shield darter	-	6	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	42	42	1.2
Walleye	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	+
Subtotal	32	1750	31	750	20	53	8	20	10	11	3	3	-	2	-	1	179	3180		
Total	1782		781		73		28		21		6		2		1		3359		3359	
Total Weight (g)	1101.7		520.8		123.5		76.1		82.7		8.8		2.0		0.9		2451.7			

+ Less than 0.05.

Table 5.2-42

Analysis of variance, random effects model, for number of fish impinged, 1974 through 1977

Source of Variation	DF	SS	MS	F
Total	87	3,809,744.500	-	-
Among Group	3	289,989.484	96,663.161	2.307
Within Group	84	3,519,755.016	41,901.845	