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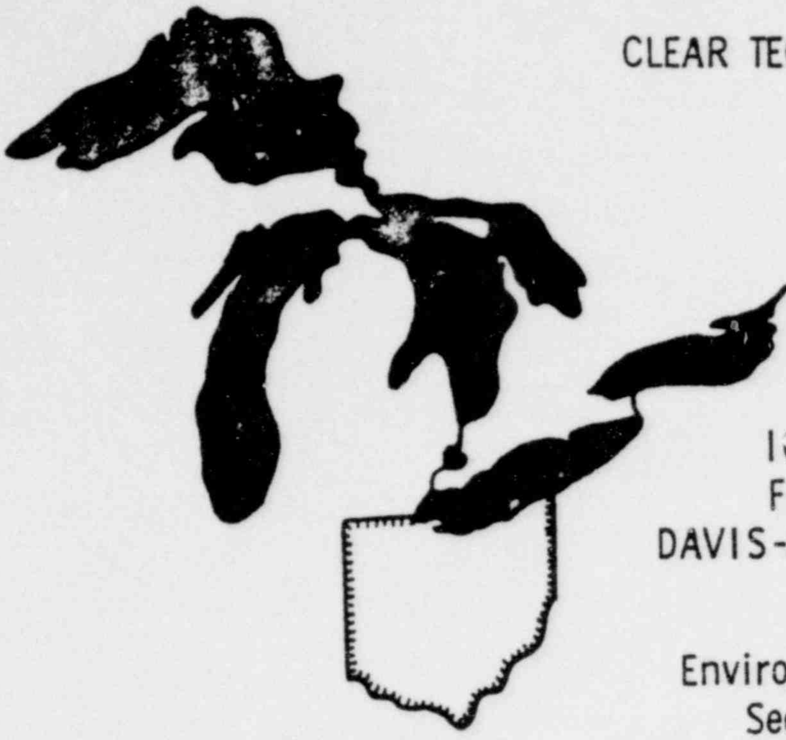

ICHTHYOPLANKTON STUDIES FROM LAKE ERIE NEAR THE DAVIS-BESSE NUCLEAR POWER STATION DURING 1978

Environmental Technical Specifications
Sec. 3.1.2.a.4 Ichthyoplankton

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3.1.2.a.4 Ichthyoplankton

Procedures

Duplicate ichthyoplankton (fish eggs and larvae) samples were collected from the surface and bottom of Stations 3 (control station), 8 (intake), 13 (plume area), 29 (control station), and Toussaint Reef (Figures 1 and 2) using a 0.75 meter diameter heavy-duty oceanographic plankton net (No. 00, 0.75 mm mesh) equipped with a calibrated General Oceanics flow meter. Each sample consisted of a 5-minute circular tow at 3 to 4 knots with this net. Samples were collected on 10 occasions (approximately 10-day intervals or as weather allowed) between 30 April 1978 and 1 September 1978 from the Locust Point vicinity and on 6 occassions at Toussaint Reef. Sampling was terminated after 1 September as only one sample on 23 August and none of the samples from 1 September contained ichthyoplankters. It sould be noted that U.S. EPA (Grosse Ile office) terminates their Western Basin sampling on 15 July each year. Samples were preserved in 5% formalin and returned to the laboratory for sorting and analysis. All specimens were identified and enumerated using the works of Fish (1932), Norden (1961a and b), and Nelson and Cole (1975). Results were reported as the number of individuals per 100 m^3 of water calculated from the volume filtered (flow meter) and the number of individuals within the sample.

Results

Specimens collected during the 1978 field season represented 11 taxa, 10 to the species level and one listed as unidentified shiner (Table 1). No eggs were collected at Toussaint Reef. Eggs were collected at Locust Point from the bottom of Stations 3 and 13 on June 8 (Table 1 and 2). Gizzard shad, emerald shiners, walleye, freshwater drum, and yellow perch were the dominant species representing 68.7 percent, 14.3 percent, 10.8 percent, 2.5 percent, and 2.1 percent, respectively of the total population at Locust Point (Table 1). No other species represented as much as 1.0 percent of the total. Gizzard shad occurred from 8 June through 11 August and peaked on 8 June at 220.9/100 m^3. Emerald shiners occurred from 8 June through 23 August and peaked on 5 July at (75.8/100 m^3. Walleye were collected on 22 May (61.0/100 m^3) and 8 June (0.1/100 m^3). Freshwater drum were collected from 8 June through 19 July with maximum density recorded on 20 June, 11.8/100 m^3. Yellow perch were collected 22 May, 8 June, and 20 June at densities of 6.3/100 m^3, 6.5/100 m^3, and 0.6/100 m^3, respectively.

Station 13 (plume area) exhibited the greatest mean larval density, 76.1/100 m^3, while, in the vicinity of the plant site, Station 8 (intake) exhibited the lowest larval density (Table 1). Overall, Toussaint Reef had the lowest larval density, 16.1/100 m^3 (Table 2). All 5 stations exhibited much greater larval densities at the surface than at the bottom. However, this increased abundance at the surface was heavily weighted by the dominance of gizzard shad and emerald shiners. Drum and white bass were more abundant at the bottom and perch and walleye were uniformly distributed in the water column.

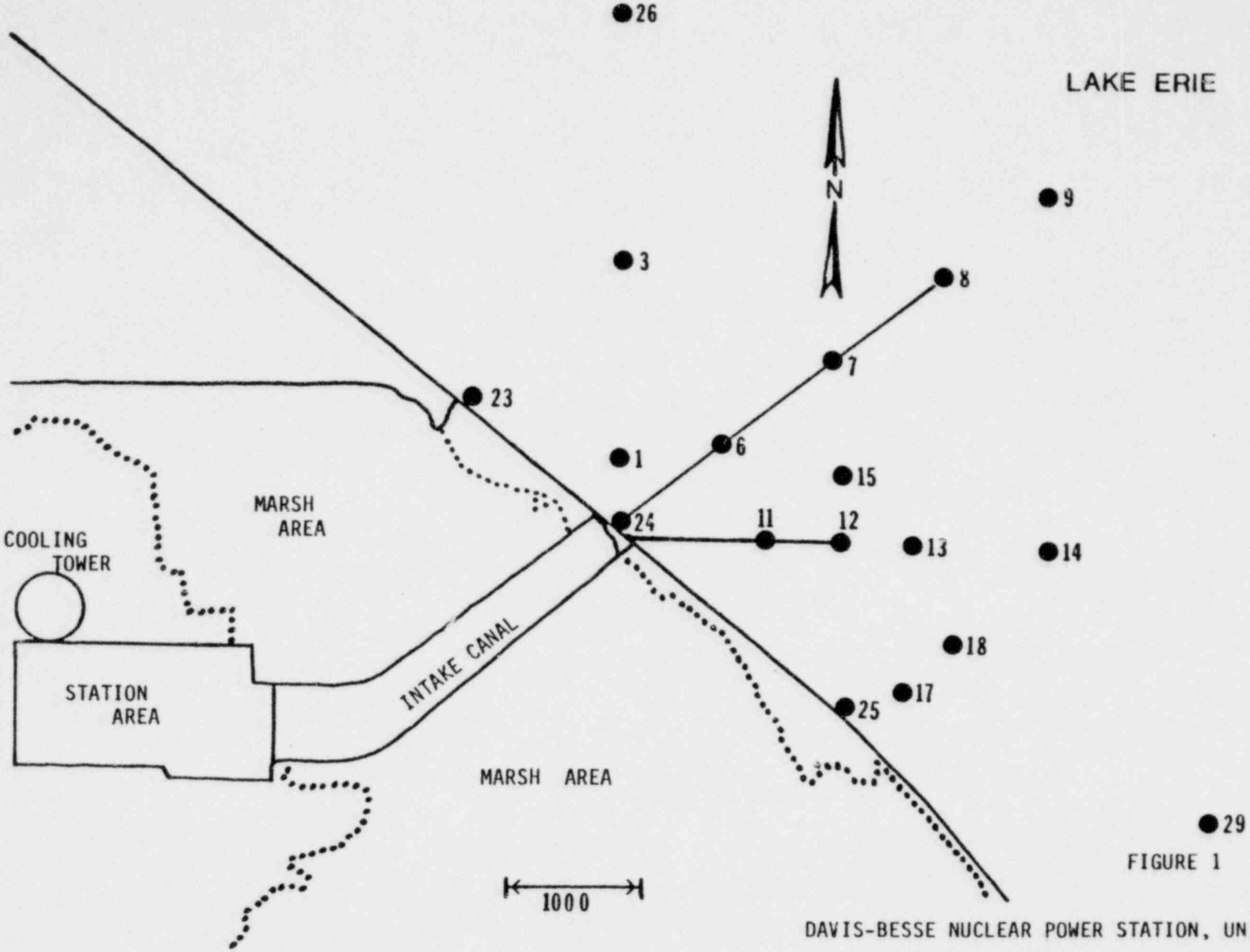

FIGURE 1

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1
AQUATIC SAMPLING STATIONS

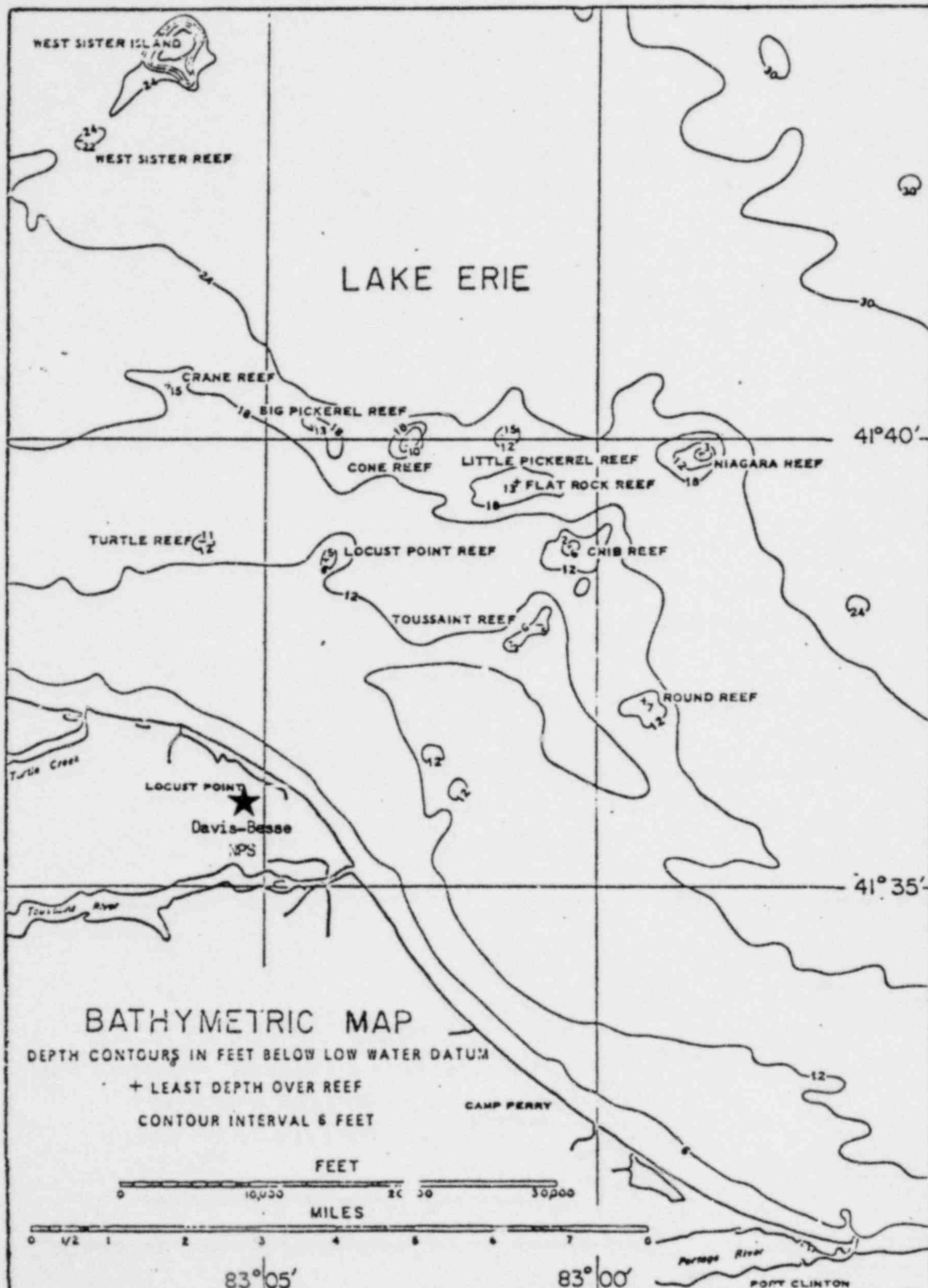

FIGURE 2. REEFS NEAR LOCUST POINT.

TABLE 1
ICHTHYOPLANKTON DENSITIES AT LOCUST POINT - 1978*

SPECIES	STATION	April 30					May 22					June 8					June 20				
		3	8	13	29	Mean	3	8	13	29	Mean	3	8	13	29	Mean	3	8	13	29	Mean
Carp	Pro-larvae													0.4	-	0.1					
	Post-larvae														-						
	Surface														-						
	Bottom													0.8	-	0.3					
	Subtotal**													0.4	-	0.1					
Emerald Shiner	Pro-larvae											0.6			-	0.2					
	Post-larvae														-						
	Surface														-						
	Bottom											1.1			-	0.4					
	Subtotal**											0.6			-	0.2					
Freshwater Drum	Pro-larvae											1.1	0.7	1.5	-	1.1	4.2	1.7	25.4	15.2	11.6
	Post-larvae														-				0.4	0.3	0.2
	Surface														-		0.8	1.8	15.9	13.0	7.9
	Bottom											2.1	1.5	2.9	-	2.2	7.6	1.5	35.8	18.0	15.7
	Subtotal**											1.1	0.7	1.5	-	1.1	4.2	1.7	25.8	15.5	11.8
Gizzard Shad	Pro-larvae											105.2	33.7	57.4	-	65.4		0.7	0.7	1.3	0.8
	Post-larvae											291.7	52.9	121.7	-	155.4	47.6	15.7	30.7	49.3	35.8
	Surface											646.8	106.1	239.1	-	330.7	53.6	31.4	32.3	59.4	44.2
	Bottom											147.0	67.1	119.2	-	111.1	41.7	1.4	30.5	41.8	28.8
	Subtotal**											396.9	86.6	179.1	-	220.9	47.6	16.4	31.4	50.6	36.5
Rainbow Smelt	Pro-larvae								1.8	4.5	1.6				-						
	Post-larvae														-						
	Surface								1.4	8.3	2.4				-						
	Bottom								2.3	0.8	0.8				-						
	Subtotal**								1.8	4.5	1.6				-						
Spottail Shiner	Pro-larvae											0.8	0.4	0.4	-	0.5	0.4	0.3	0.6		0.3
	Post-larvae														-					0.4	0.1
	Surface											0.6		0.8	-	0.5	0.8	0.6	1.1	0.7	0.8
	Bottom											1.0	0.7		-	0.6					
	Subtotal**											0.8	0.4	0.4	-	0.5	0.4	0.3	0.6	0.4	0.4
Unidentified Shiner	Pro-larvae														-						
	Post-larvae											0.3			-	0.1					
	Surface														-						
	Bottom											0.6			-	0.2					
	Subtotal**											0.3			-	0.1					
Walleye	Pro-larvae						52.1	6.0	65.2	120.8	61.0			0.4	-	0.1					
	Post-larvae														-						
	Surface						23.8	1.9	57.2	181.3	66.1			0.8	-	0.3					
	Bottom						80.3	10.1	73.1	60.3	56.0				-						
	Subtotal**						52.1	6.0	65.2	120.8	61.0			0.4	-	0.1					
White Bass	Pro-larvae											1.8	0.4	2.5	-	1.6	0.5	0.4		1.6	0.6
	Post-larvae											1.0	0.4		-	0.5	2.1	0.4	1.3	3.1	1.7
	Surface											1.2		1.8	-	1.0	0.8	0.7	1.8	3.4	1.7
	Bottom											4.4	1.5	3.2	-	3.0	4.3	0.7	0.8	6.0	3.0
	Subtotal**											2.8	0.8	2.5	-	2.0	2.6	0.8	1.3	4.7	2.4
Whitefish	Pro-larvae		0.4			0.1									-						
	Post-larvae														-						
	Surface		0.8			0.2									-						
	Bottom														-						
	Subtotal**		0.4			0.1									-						
Yellow Perch	Pro-larvae						4.0	4.8	7.7	8.5	6.3	0.3	0.3	1.7	-	0.8					
	Post-larvae											5.6	4.5	7.0	-	5.7		0.6	1.0	0.7	0.6
	Surface						4.0	8.6	6.9	12.3	8.0	1.7	1.4	7.2	-	3.4		1.2	1.1		0.6
	Bottom						4.1	1.0	8.5	4.8	4.6	10.2	8.3	10.2	-	9.6			0.8	1.3	0.5
	Subtotal**						4.0	4.8	7.7	8.5	6.3	5.9	4.8	8.7	-	6.5		0.6	1.0	0.7	0.6
Total	Pro-larvae		0.4			0.1	56.1	10.8	74.7	133.9	68.9	109.8	35.5	64.3	-	69.9	5.1	3.0	26.7	18.1	13.2
	Post-larvae											298.6	57.8	128.7	-	161.7	49.7	16.7	33.4	53.7	38.4
	Surface		0.8			0.2	27.8	10.5	65.5	201.8	76.4	650.3	107.4	249.6	-	251.8	56.2	35.8	52.3	76.5	55.2
	Bottom						84.4	11.1	83.9	65.9	61.3	166.4	79.1	136.4	-	127.3	53.6	3.6	67.8	67.1	48.0
	Subtotal**		0.4			0.1	56.1	10.8	74.7	133.9	68.9	400.4	93.3	193.1	-	231.6	54.9	19.7	60.1	71.8	51.6
Eggs	Surface														-						
	Bottom											8.7		6.3	-	5.0					
	Subtotal**											4.3		3.1	-	2.5					

TABLE 1 (CONTINUED)
ICHTHYOPLANKTON DENSITIES AT LOCUST POINT - 1978*

SPECIES	STATION	July 5					July 19					August 1					August 11				
		3	8	13	29	Mean	3	8	13	29	Mean	3	8	13	29	Mean	3	8	13	29	Mean
Carp	Pro-larvae		0.4			0.1															
	Post-larvae																				
	Surface		0.9			0.2															
	Bottom																				
	Subtotal**		0.4			0.1															
Emerald Shiner	Pro-larvae	54.7	62.0	92.0	58.4	66.8							0.3	0.3	0.6	0.3	0.3				0.1
	Post-larvae	3.8	6.5	22.4	3.5	9.1						1.3	0.3	0.3		0.5	0.2	1.8			0.5
	Surface	109.4	136.0	174.9	120.5	135.2						2.6	1.1	1.1	1.1	1.5	0.6	3.6			1.1
	Bottom	7.6	0.9	53.9	3.3	16.4											0.4				0.2
	Subtotal**	58.5	68.5	114.4	61.9	75.8						1.3	0.6	0.6	0.6	2.3	0.5	1.8			0.6
Freshwater Drum	Pro-larvae		1.0			0.2	0.3	0.9	0.7	1.0	0.7										
	Post-larvae																				
	Surface		0.9			0.2	0.6		1.1	0.5	0.6										
	Bottom		1.2			0.3		1.8	0.4	1.6	1.0										
	Subtotal**		1.0			0.2	0.3	0.9	0.7	1.0	0.7										
Gizzard Shad	Pro-larvae	5.8	12.7	198.1		54.2		1.4	7.4	12.4	5.3	1.6				0.4	13.7	66.5	0.3	0.3	20.2
	Post-larvae	128.8	28.2	101.8	82.0	85.2	9.8	5.1	2.6	18.4	9.0	1.3	7.2	2.3	11.3	5.5	1.5	0.3	3.9	3.4	2.[illegible]
	Surface	51.3	57.5	358.5	9.7	119.3	12.4	5.3	13.4	23.5	13.7	3.0	12.4	2.7	19.3	9.4	25.7	98.9	1.7	6.3	33.2
	Bottom	217.9	24.3	241.4	154.3	159.5	7.1	7.7	6.6	38.1	14.9	2.9	2.0	2.0	3.3	2.6	4.6	34.8	6.7	1.1	11.8
	Subtotal**	134.6	40.9	299.9	82.0	139.4	9.8	6.5	10.0	30.8	14.3	2.9	7.2	2.3	11.3	5.9	15.2	66.8	4.2	3.7	22.5
Rainbow Smelt	Pro-larvae																				
	Post-larvae							0.2		0.3	0.1							0.4		0.3	0.2
	Surface																				
	Bottom							0.4		0.5	0.2							0.8		0.5	0.3
	Subtotal**							0.2		0.3	0.1							0.4		0.3	0.2
Spottail Shiner	Pro-larvae								0.6		0.2										
	Post-larvae																				
	Surface								1.2		0.3										
	Bottom																				
	Subtotal**								0.6		0.2										
Unidentified Shiner	Pro-larvae																				
	Post-larvae																				
	Surface																				
	Bottom																				
	Subtotal**																				
Walleye	Pro-larvae																				
	Post-larvae																				
	Surface																				
	Bottom																				
	Subtotal**																				
White Bass	Pro-larvae																			0.3	0.1
	Post-larvae																				
	Surface																				
	Bottom																			0.5	0.1
	Subtotal**																			0.3	0.1
Whitefish	Pro-larvae																				
	Post-larvae																				
	Surface																				
	Bottom																				
	Subtotal**																				
Yellow Perch	Pro-larvae																				
	Post-larvae																				
	Surface																				
	Bottom																				
	Subtotal**																				
Total	Pro-larvae	60.5	76.2	290.1	58.4	121.3	0.3	2.3	8.8	13.5	6.2	1.6	0.3	0.2	0.6	0.8	14.0	66.6	0.3	0.6	20.4
	Post-larvae	132.5	34.6	124.2	85.9	94.3	9.8	5.3	2.6	18.6	9.1	2.6	7.5	2.6	11.3	6.0	1.7	2.4	3.9	3.6	2.9
	Surface	160.6	195.3	533.3	130.2	254.9	13.0	5.3	15.8	24.0	14.5	5.6	13.5	3.7	20.4	10.8	26.3	102.4	1.7	6.3	34.2
	Bottom	225.4	26.4	295.3	157.6	176.2	7.1	9.9	7.0	40.3	16.1	2.9	2.0	2.0	3.3	2.6	5.1	35.6	6.7	2.1	12.4
	Subtotal**	193.0	110.8	414.3	143.9	215.5	10.1	7.6	11.4	32.1	15.3	4.2	7.8	2.8	11.9	6.7	15.7	69.0	4.2	4.3	23.3
Eggs	Surface																				
	Bottom																				
	Subtotal**																				

TABLE 1 (CONTINUED)
ICHTHYOPLANKTON DENSITIES AT LOCUST POINT - 1978*

SPECIES	STATION	August 23: 3	8	13	29	Mean	September 1: 3	8	13	29	Mean	Mean: 3	8	13	29	Mean
Carp	Pro-larvae												<0.1			<0.1
	Post-larvae															
	Surface												0.1			<0.1
	Bottom													0.1		<0.1
	Subtotal**												<0.1	<0.1		<0.1
Emerald Shiner	Pro-larvae	0.3				0.1						5.6	6.2	9.2	6.6	6.9
	Post-larvae											1.4	0.9	2.2	0.4	1.2
	Surface	0.6				0.2						11.3	14.1	17.6	13.5	14.1
	Bottom											0.9	0.1	5.4	0.4	1.7
	Subtotal**	0.3				0.1						7.0	7.1	11.4	7.0	8.1
Freshwater Drum	Pro-larvae											0.6	0.4	3.3	1.8	1.5
	Post-larvae															
	Surface											0.1	0.3	1.7	1.5	0.9
	Bottom											1.0	0.6	3.9	2.2	1.9
	Subtotal**											0.6	0.4	2.8	1.8	1.4
Gizzard Shad	Pro-larvae											12.6	11.5	26.4	1.6	15.8
	Post-larvae											48.1	10.9	26.3	18.3	25.9
	Surface											79.3	31.2	64.8	13.1	47.1
	Bottom											42.1	13.7	40.1	26.5	30.6
	Subtotal**											60.7	22.4	52.7	19.8	38.9
Rainbow Smelt	Pro-larvae													0.2	0.5	0.2
	Post-larvae												0.1		0.1	0.1
	Surface													0.1	0.9	0.3
	Bottom												0.1	0.2	0.2	0.1
	Subtotal**												0.1	0.2	0.6	0.2
Spottail Shiner	Pro-larvae											0.1		0.2		0.1
	Post-larvae															
	Surface											0.1	0.1	0.3	0.1	0.2
	Bottom											0.1	0.1			0.1
	Subtotal**											0.1	0.1	0.2	<0.1	0.1
Unidentified Shiner	Pro-larvae															
	Post-larvae											<0.1				<0.1
	Surface															
	Bottom											0.1				<0.1
	Subtotal**											<0.1				<0.1
Walleye	Pro-larvae											5.2	0.6	6.6	13.4	6.1
	Post-larvae															
	Surface											2.4	0.2	5.3	20.1	6.6
	Bottom											8.0	1.0	7.3	6.7	5.6
	Subtotal**											5.2	0.6	6.5	13.4	6.1
White Bass	Pro-larvae											0.2	0.1	0.3	0.2	0.2
	Post-larvae											0.3	0.1	0.1	0.3	0.2
	Surface											0.2	0.1	0.4	0.4	0.3
	Bottom											0.9	0.2	0.4	0.7	0.6
	Subtotal**											0.5	0.2	0.4	0.6	0.4
Whitefish	Pro-larvae												<0.1			<0.1
	Post-larvae															
	Surface												0.1			<0.1
	Bottom															
	Subtotal**												<0.1			<0.1
Yellow Perch	Pro-larvae											0.4	0.5	0.9	0.9	0.7
	Post-larvae											0.6	0.5	0.8	0.1	0.5
	Surface											0.6	1.1	1.5	1.4	1.2
	Bottom											1.4	0.9	2.0	0.7	1.3
	Subtotal**											1.0	1.0	1.7	1.0	1.2
Total	Pro-larvae	0.3				0.1						24.8	19.5	46.5	25.0	29.0
	Post-larvae											49.5	12.4	29.5	19.2	27.7
	Surface	0.6				0.2						94.0	47.1	92.2	51.0	71.1
	Bottom											54.5	16.8	59.9	37.4	42.2
	Subtotal**	0.3				0.1						74.3	31.9	76.1	44.2	56.6
Eggs	Surface															
	Bottom											0.9		0.6		0.2
	Subtotal**											0.4		0.3		0.2

* Data presented as no./100m^3. A "dash" indicates no collection due to bad weather.

** Subtotal of Pro and Post - larvae, mean of surface and bottom samples.

TABLE 2

RESULTS OF ICHTHYOPLANKTON COLLECTIONS
AT TOUSSAINT REEF - 1978

SPECIES	DATE*	April 30	May 22	June 20	July 5	Aug. 11	Sept. 1	Mean
CARP	Prolarvae				0.8			0.1
	Post Larvae							
	Surface				1.6			0.3
	Bottom							
	Subtotal				0.8			0.1
Emerald Shiner	Prolarvae			4.2	50.3	5.2		10.0
	Post Larvae				61.6			10.3
	Surface			8.4	221.8	8.9		39.9
	Bottom				1.9	1.6		0.6
	Subtotal			4.2	111.9	5.2		20.2
Freshwater Drum	Prolarvae			8.2				1.4
	Post Larvae							
	Surface							
	Bottom			16.4				2.7
	Subtotal			8.2				1.4
Gizzard Shad	Prolarvae			2.8				0.5
	Post Larvae			2.4	1[illegible].6			2.7
	Surface			2.0	[illegible]2.0			4.0
	Bottom			8.4	[illegible].1			2.3
	Subtotal			5.2	13.6			3.1
Rainbow Smelt	Prolarvae							
	Post Larvae				0.3			0.1
	Surface				0.[illegible]			0.1
	Bottom							
	Subtotal				0.3			0.1
Spottail Shiner	Prolarvae							
	Post Larvae					0.3		0.1
	Surface					0.6		0.1
	Bottom							
	Subtotal					0.3		0.1
Unidentified Shiner	Prolarvae							
	Post Larvae							
	Surface							
	Bottom							
	Subtotal							
Walleye	Prolarvae		1.3					0.2
	Post Larvae							
	Surface							
	Bottom		2.5					0.4
	Subtotal		1.3					0.2
White Bass	Prolarvae							
	Post Larvae							
	Surface							
	Bottom							
	Subtotal							
Whitefish	Prolarvae							
	Post Larvae							
	Surface							
	Bottom							
	Subtotal							
Yellow Perch	Prolarvae		5.3					0.9
	Post Larvae							
	Surface		6.7					1.1
	Bottom		3.9					0.7
	Subtotal		5.3					0.9
TOTAL	Prolarvae		6.6	15.3	5[illegible].1	5.2		13.0
	Postlarvae			2.4	75.5	0.3		13.1
	Surface		6.7	10.4	246.1	9.4		45.4
	Bottom		6.4	24.8	7.0	1.6		6.6
	Subtotal		6.6	17.7	126.6	5.5		26.1

* Samples could not be collected on 19 July and 23 August due to artillery firing into this zone and on 8 June and 1 August because of wind and high waves.

All raw data were keypunched and stored at the offices of the Ohio State University's Center for Lake Erie Area Research in Columbus, Ohio. A voucher collection of all samples is also maintained at these offices.

Analysis

Ichthyoplankton populations have shown tremendous variations since 1974. Emerald shiners constituted 81 percent of the 1974 larvae, 1 percent of the 1975 larvae, 60 percent of the 1976 larvae, 3 percent of the 1977 larvae, and 14 percent of the 1978 larvae. Yellow perch constituted 5 percent of the 1974 larvae, 70 percent of the 1975 larvae, 4 percent of the 1976 larvae, 26 percent of the 1977 larvae, and 2 percent of the 1978 larvae. Gizzard shad appear to have increased significantly reaching 34 percent of the 1976 larvae, 56 percent of the 1977 larvae, and 69 percent of the 1978 larvae. It is felt that the above described variability is largely due to the fact that we are sampling schooling specimens. Consequently, when the net is drawn through a school the density appears quite high. This is also quite dependent on the seasonal frequency of sampling. For example, if the weather allows more frequent spring sampling but prohibits summer sampling, then spring species such as perch and walleye appear relatively more abundant.

This is the second year that walleye have constituted a significant portion of the catch. However, as noted last year, adult populations throughout the Western Basin are increasing greatly and, consequently, greater larval populations are to be expected (Scholl, 1978). These walleye larvae contributed to the 53 percent increase observed in larval densities from 1977 (mean density = 37.0/100 m^3) to 1978 (mean density = 56.6/100 m^3). However, gizzard shad were the major source of this increase as their mean densities increased from 20.7/100 m^3 in 1977 to 38.9/100 m^3 in 1978. Yellow perch densities decreased significantly from 9.5/100 m^3 in 1977 to 1.2/100 m^3 in 1978. This decrease is similar to that observed by the Ohio Division of Wildlife for the adult population (Scholl, 1979).

In 1976, control stations (3 and 29) were established on either side of the intake (Station 8)/discharge complex (Station 13) to determine if unusually large fish larvae populations were occurring due to possible spawning in the rip-rap material around these structures. This does not appear to be occurring to any significant degree as Station 13 plume area) exhibited densities similar to Station 3 (control) and Station 8 (intake) exhibited the lowest densities. These lower densities observed at Station 8 are probably due to the fact that this station is the furthest from shore and in the deepest water.

In summary, there is no indication of significant spawning occurring at Locust Point. However, the nearshore waters here, as with the rest of the nearshore waters along the south shore of the Western Basin, appear to serve as a nursery ground for larvae. Furthermore, due to the similarity between test and control stations, there is no indication that the activities of the plant have significantly altered these populations.

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XIII

Section 3.1.2.a.5
Fish Egg and Larvae Entrainment

3.1.2.a.5 Fish Egg and Larvae Entrainment

Procedures

Fish egg and larvae (ichthyoplankton) entrainment at the Davis-Besse Nuclear Power Station was computed by multiplying the ichthyoplankton concentration observed at Station 8 (intake) by the intake volume (Figure 1). Ichthyoplankton densities were determined at approximately 10-day intervals from four 3-minute, oblique (bottom to surface) tows at 3-4 knots made at night on each date (Table 1) with a 0.75 meter diameter heavy-duty oceanographic plankton net (No. 00, 0.75 mm mesh) equipped with a calibrated General Oceanics flowmeter. Oblique tows were selected as this is the technique required at intakes on Lake Erie by U.S. Environmental Protection Agency and U.S. Fish and Wildlife Service. Night sampling is also required by these agencies to minimize net avoidance by larvae and to more accurately assess populations of species which may cling to the bottom during daylight. Samples were preserved in 5% formalin and returned to the laboratory for sorting and analysis. All specimens were identified and enumerated using the works of Fish (1932), Norden (1961a and b), and Nelson and Cole (1975). Densities were presented as number of ichthyoplankters per 100 m^3 of water.

From the above estimates it was possible to determine an approximate period of occurrence for each species and a mean density during that period. For example, walleye were not found on 30 April or on 7 June or later (Table 1). They were present in samples from 11 May and 21 May. Therefore, the period of occurrence was estimated to have been from 6 May (the midpoint between 30 April and 11 May) to 30 May (the midpoint between 21 May and 7 June) (Table 2). The mean density of walleye during this period was estimated to have been 41.6/100 m^3, computed from the concentration of 79.2/100 m^3 observed on 11 May and the concentration of 4.0/100 m^3 observed on 21 May. It was this concentration, 41.6/100 m^3, which was multiplied by the volume of water drawn through the plant from 6 May to 30 May.

The daily intake volume was computed by multiplying the daily discharge volume by 1.3. The daily intake volumes were then added for all days within the period of occurrence of the species in question to determine the total intake volume during the period. All specimens were vouchered and all data were keypunched and stored at The Ohio State University's Center for Lake Erie Area Research, Columbus, Ohio.

Results

Ichthyoplankton densities observed at Station 8 (intake) during 1978 indicated that ichthyoplankters were entrained at the Davis-Besse Nuclear Power Station from 6 May to 17 August (Table 1). May 6 was selected as the first day since it is midway between 30 April and 11 May. August 17 was selected as the last day because larvae were present in night samples on 11 August (Table 1) but were absent from day samples at Station 8 on 23 August and later (See Table 1, Section 3.1.2.a.4 Ichthyoplankton).

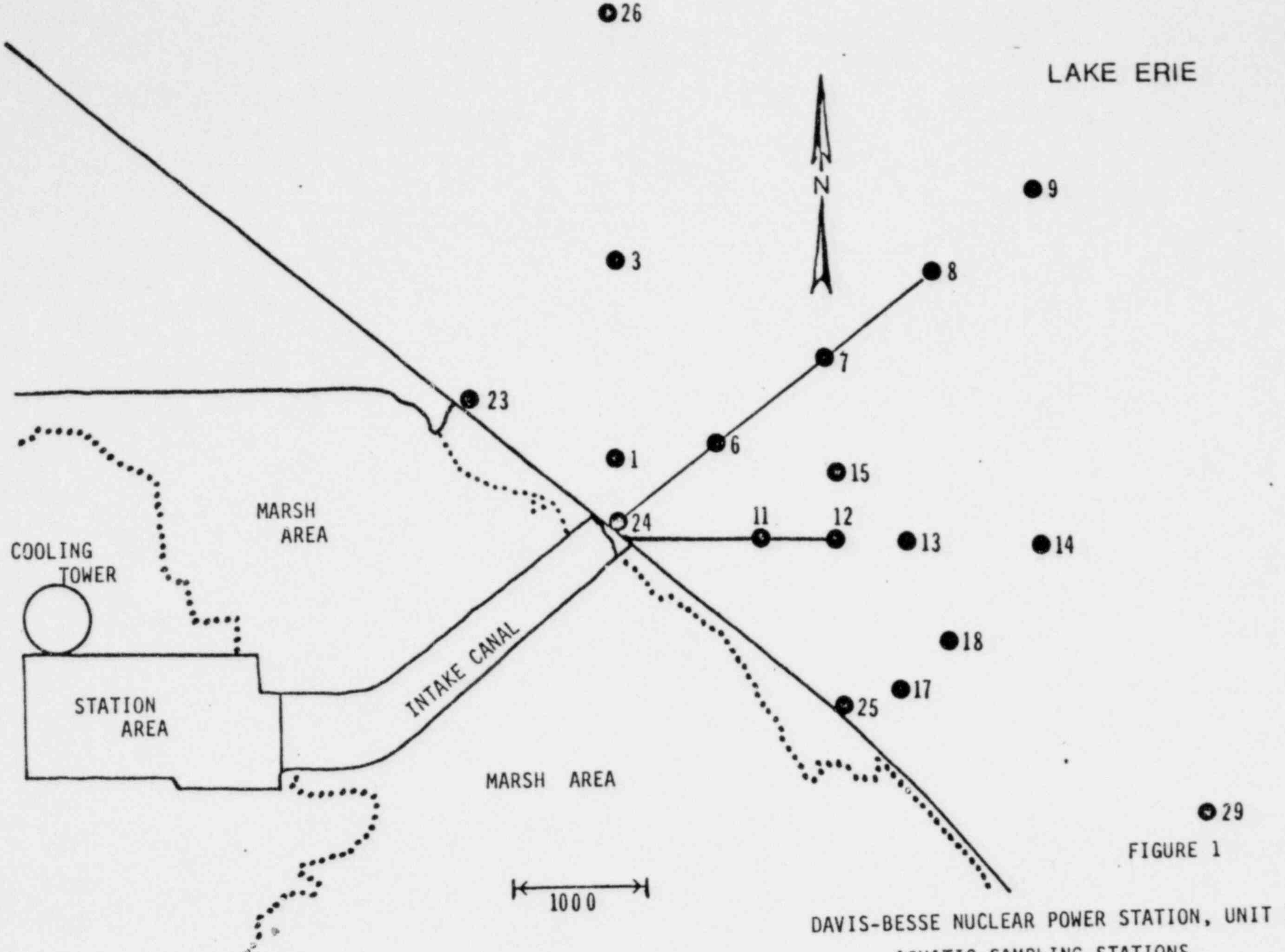

FIGURE 1

DAVIS-BESSE NUCLEAR POWER STATION, UNIT 1
AQUATIC SAMPLING STATIONS

TABLE 1

ICHTHYOPLANKTON DENSITIES IN THE VICINITY OF THE INTAKE OF THE DAVIS - BESSE NUCLEAR POWER STATION - 1978*

SPECIES	STAGE \ DATE	April 30	May 11	May 21	June 7	July 4	July 19	Aug. 1	Aug. 11	MEAN
Carp	Pro-larvae					0.3				0.04
	Post-larvae									
	Subtotal					0.3				0.04
Emerald Shiner	Pro-larvae					14.7				1.84
	Post-larvae					1.6		1.6	0.8	0.50
	Subtotal					16.3		1.6	0.8	2.34
Freshwater Drum	Pro-larvae			0.7		4.9				0.70
	Post-larvae					0.4				0.05
	Sub-total			0.7		5.3				0.75
Gizzard Shad	Pro-larvae				16.4				0.4	2.10
	Post-larvae				5.2	181.9	30.0	3.6	24.3	30.63
	Subtotal				21.6	181.9	30.0	3.6	24.7	32.73
Rainbow Smelt	Pro-larvae			0.7						0.09
	Post-larvae						4.2		0.6	0.60
	Subtotal			0.7			4.2		0.6	0.69
Spottail Shiner	Pro-larvae				0.3					0.04
	Post-larvae						0.4		0.2	0.08
	Subtotal				0.3		0.4		0.2	0.11
Walleye	Pro-larvae		79.2	4.0						10.40
	Post-larvae									
	Subtotal		79.2	4.0						10.40
Yellow Perch	Pro-larvae		1.4	1.8						0.40
	Post-larvae									
	Subtotal		1.4	1.8						0.40
TOTAL LARVAE	Pro-larvae		80.6	7.2	16.7	19.9			0.4	15.60
	Post-larvae				5.2	183.9	34.6	5.2	25.9	31.85
	Subtotal		80.6	7.2	21.9	203.8	34.6	5.2	26.3	47.45
EGGS					2.4					0.30

* Data presented as number of individuals per $100 m^3$ and computed from 4 oblique tows (bottom to surface) collected at night.

TABLE 2

. ICHTHYOPLANKTON ENTRAINMENT AT THE
DAVIS-BESSE NUCLEAR POWER STATION - 1978

SPECIES	PERIOD DURING WHICH ENTRAINMENT OCCURRED [a]	Volume of Water ($100m^3$) withdrawn during period [b]	Larvae per $100m^3$ [c]	Number of Larvae Entrained
Carp	21 June - 12 July	20,443	0.30	6,133
Emerald Shiner	21 June - 17 August	73,704	4.68	344,933
Freshwater Drum	16 May - 12 July	49,951	2.00	99,901
Gizzard Shad	30 May - 17 August	91,598	52.37	4,796,964
Rainbow Smelt	16 May - 17 August	103,211	0.92	94,955
Spottail Shiner	30 May - 17 August	91,598	0.18	16,488
Walleye	6 May - 30 May	22,037	41.60	916,738
Yellow Perch	6 May - 30 May	22,037	1.60	35,259
TOTAL				6,311,371
Eggs	30 May - 21 June	18,449	2.40	44,278

[a] Estimated from Table 1. See discussion on page .

[b] Estimated by multiplying daily discharge rate by 1.3 and adding all daily estimates for the specified period.

[c] Average concentration during their period of occurrence.

The mean larvae density from all night samples at Station 8 (47.5/100 m^3) was 49 percent greater than the mean density from all day samples collected at Station 8 (31.9/100 m^3). Gizzard shad constituted 69 percent of the night ichthyoplankton population followed by walleye at 22 percent and emerald shiners at 5 percent (Table 1).

Based on the above results (Table 1), it is estimated that 6,311,371 larvae and 44,278 eggs were entrained at the Davis-Besse Nuclear Power Station during 1978 (Table 2). Of this total, gizzard shad constituted 76 percent, walleye 15 percent, and emerald shiners 5 percent.

Analysis

Ichthyoplankton entrainment at the Davis-Besse Nuclear Power Station during 1978 was typical for an intake on the south shore of the Western Basin of Lake Erie--it was strongly dominated by gizzard shad. As explained in the ichthyoplankton section of this report (Section 3.1.2.a.4), gizzard shad are on the increase and, consequently, it would not be surprising if they represented even a greater portion of the entrainment next year. Walleye is another species which is increasing greatly in the Western Basin. This species constituted 0.02 percent of the 1976 population, 11 percent of the 1977 population and, now, 22 percent in 1978 (Reutter and Herdendorf, 1977; Reutter, 1978). The brood stock of walleye in the Western Basin is still increasing so ichthyoplankton densities next year may be even greater. Perch entrainment was very low in 1978 as would be expected since this population is currently declining (Scholl, 1979).

One way to put entrainment losses into perspective is to look at fecundity. Based on an average of 300,000 eggs/female gizzard shad (Hartley and Herdendorf, 1977), the 4,796,964 larvae could have been produced by 16 females; based on an average of 331,000 eggs/female walleye (Hartley and Herdendorf, 1977), the 916,738 entrained larvae could have been produced by 3 females; and based on 44,000 eggs/female yellow perch (Hartley and Herdendorf, 1977) the 35,259 entrained larvae could have been produced by 1 female. In actuality, the above estimates of the number of females required to produce the entrained larvae are quite low since they do not take mortality from eggs to larvae into account. If we assume 99 percent mortality from eggs to larvae to be safe (90 percent is probably more reasonable) then the entrained larvae could have been produced by 1,600 gizzard shad, 300 walleyes, and 100 perch. These values are less than 0.1 percent of the number of perch and walleye captured by Ohio sport fishermen in 1978 (Scholl, 1979).

Another way to determine the impact of entrainment losses is to estimate the number of adults the entrained larvae would have produced had they lived. This technique requires some knowledge of the mortality between larval stages and between year classes. Patterson (1976) has developed such estimates for yellow perch, and, since it is in the same family, the estimates will also be used here for walleye. Several assumptions are involved.

I. All entrained larvae are killed.

II. All larvae lost by entrainment are in their late larval stage. This provides a conservative or high estimate because it does not account for early larval mortality which may range from 83-96 percent (Patterson, 1976).

III. Yellow perch become vulnerable to commercial capture, and reach sexual maturity at age class III.

IV. A one percent survival rate from late larvae to age III adults is assumed. Again, this is conservative since survival rates from:

late larvae to YOY = 4 to 17 percent;
YOY to age class I = 12 to 33 percent;
age class I to age class II = 38 percent;
age class II to age class III = 38 percent (Patterson, 1976, and Brazo, et al., (1975).

This trend translates to a survivorship ranging from 0.1 percent to one percent over the period from the late larval stage to age class III.

Based on the above assumptions, the 916,738 entrained walleye larvae could have produced 917-9,167 age class III adults and the 35,259 entrained yellow perch larvae could have produced 35-353 age class III adults.

The author feels little weight should be placed on the above impact assessments since they are based on the number of entrained larvae which can vary greatly from year to year depending on the success of the hatch which in turn is dependent upon the size of the brood stock and weather conditions during spawning and incubation. In the case of Davis-Besse, the off-shore intake where larvae densities are lower (See Section 3.1.2.a.4) and the low volume intake (1978 mean = 21,389 gpm) due to the cooling tower and closed cooling system necessitate a very low-level impact on Western Basin fish populations.

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3.1.2.a.6