



Please note that the following are pages from this referenced report.
When viewing the pages:
Impingement means caught against the screens
Entrainment means thru the screens
There are juvenile fish that are entrained
The weight of the fish is expressed in kilograms
1 kg = 2.2 pounds
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sandylakeerie@aol.com
419-691-3788

**BAY SHORE POWER PLANT
FISH ENTRAINMENT AND IMPINGEMENT STUDY REPORT**

Kinectrics Report: 112026-005-RA-0001-R00

December, 2007

D.D. Ager, I. Cord, S. Rkman-Filipovic, P.H. Patrick
Environmental and Aquatic Management Services

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Kinectrics Inc., 800 Kipling Avenue
Toronto, Ontario, Canada M8Z 6C4



Figure 2. Intake at the Bay Shore Power Plant

Table 8
Annual Estimate of Fish Larvae Entrained at Bay Shore Power Plant
(May 2005 – May 2006)

Species	Bay Shore - Annual Number of Entrained Larvae								% of Total
	May 05/06	Jun-05	Jul-05	Aug-05	Sep-05	Mar-06	Apr-06	Total	
Freshwater drum		977,312,351	79,788	34,772				977,426,912	43.5%
Rainbow smelt/Clupeidae	119,920,367	415,780,097	519,964				45,406	536,265,835	23.9%
Unidentifiable	38,613,971	426,336,716	165,664	66,103			762,596	465,945,050	20.7%
Morone spp.	100,211,180	37,242,661	95,920					137,549,760	6.1%
Logperch	21,814,479	8,600,492					2,348,669	32,763,640	1.5%
White sucker	232,238	28,964,338						29,196,575	1.3%
Emerald shiner		18,826,286	175,288					19,001,574	0.8%
White bass		17,816,675	23,581					17,840,256	0.8%
Walleye	5,820,753	793,968					1,543,107	8,157,828	0.4%
Cyprinidae	449,942	7,010,821	23,581					7,484,343	0.3%
Notropis spp.		4,707,966						4,707,966	0.2%
Yellow perch	919,867	1,258,759	63,356	62,662			875,848	3,180,492	0.1%
Percidae	568,882						1,731,756	2,300,638	0.1%
Common carp/Goldfish	36,890	2,018,974	87,326					2,143,190	0.1%
Catostomidae	638,744							638,744	0.03%
Trout-perch		655,666						655,666	0.03%
Walleye/Yellow perch							616,543	616,543	0.03%
White perch		488,198	23,581					511,779	0.02%
Lepomis spp.		17,436		250,649				268,084	0.01%
Grass pickerel	92,453						45,328	137,782	0.01%
Pomoxis spp.		180,015						180,015	0.01%
Burbot	84,256							84,256	0.004%
Spottail shiner		56,596	23,228					79,825	0.004%
Channel catfish			70,390					70,390	0.003%
Centrarchidae	21,064							21,064	0.001%
Lake whitefish							20,814	20,814	0.001%
Total	289,425,086	1,948,068,015	1,351,666	414,186	0	0	7,990,066	2,247,249,020	100.0%

Individual estimates may not add to totals due to rounding.

**Table 11. Comparison of Larval Entrainment at Bay Shore
(2005-2006 versus 1976-1977)**

Species	Larval Density at Intake (Larvae per 100 m ³)		Annual Number of Larvae Entrained		Estimated River Population		% of River Population	
	2005	1976-1977	2005	1976-1977	2005	1976-1977	2005	1976-1977
Bluegill				28,201		0		
Burbot	0.02		84,256		733,665		11.5%	
Catostomidae	0.2		638,744		7,162,070		8.9%	
Centrarchidae	0.005		21,064		183,416		11.5%	
Channel catfish	0.01		70,390	564,532	550,249	0	12.8%	
Common carp/Goldfish	0.5	1.9	2,300,638	8,251,539	21,459,693	12,590,973	10.7%	65.5%
Crappie				28,778		3,027,329		1.0%
Cyprinidae	1.9		7,484,343		73,733,305		10.2%	
Emerald shiner	5.0		19,001,574	142,572	197,539,229	5,172,246	9.6%	2.8%
Freshwater drum	246.9	3.4	977,426,912	13,479,134	9,704,476,157	139,656,878	10.1%	9.7%
Grass pickerel	0.03		180,015		1,100,497		16.4%	
Green sunfish						27,771		0.0%
Lake whitefish	0.005		20,814		183,416		11.3%	
Lepomis spp.	0.04		268,084		1,650,746		16.2%	
Logperch	6.8		29,196,575	28,778	266,136,881	285,804	11.0%	10.1%
Morone spp.	32.3		137,549,760		1,271,449,818		10.8%	
Notropis spp.	1.2		4,707,966		48,055,040		9.8%	
Percidae	0.5		2,143,190		19,808,948		10.8%	
Pomoxis spp.	0.04		137,782		1,467,329		9.4%	
Quillback carpsucker						28,358		0.0%
Rainbow smelt/Clupeidae	124.7	55.9	536,265,835	224,187,505	4,900,513,140	6,522,661,227	10.9%	3.4%
Spottail shiner	0.02		79,825	238,132	733,665	1,937,219	10.9%	12.3%
Trout-perch	0.1		655,666	12,747	5,869,318	0	11.2%	
Unidentifiable	116.7		465,945,050	88,078	4,586,878,226	2,610,012	10.2%	3.4%
Unidentified shiner				166,784		276,446		60.3%
Unidentified sucker				357,889		357,167		100.2%
Unidentified sunfish				493,434		16,540,804		3.0%
Walleye	2.1	0.1	8,157,828	441,614	83,087,531	6,049,074	9.8%	7.3%
Walleye/Yellow perch	0.1	0.7	511,779		5,135,653		10.0%	
White bass	4.5	13.4	17,840,256	33,107,855	177,188,967	560,518,850	10.1%	5.9%
White crappie						27,771		0.0%
White perch	0.1		616,543		5,319,069		11.6%	
White sucker	7.4		32,763,640	637,614	269,448,768	1,857,758	11.3%	34.3%
Yellow perch	0.7		3,180,492	2,426,431	25,861,682	29,630,704	12.3%	8.2%
Total	551.9	86.2	2,247,249,020	284,681,617	21,695,726,497	7,303,256,391	10.4%	3.9%

**Table 13
Estimated Number of Live and Recently Dead Juvenile Fish Entrained each Month at Bay Shore Power Plant
(May 2005 – May 2006)**

Species	Bay Shore - Number of Entrained Juveniles (Excluding Long Dead Juveniles)									
	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Mar-06	Apr-06	May-06	TOTAL	% of Total
Rainbow smelt/Clupeidae		3,962,049	23,581	31,331					4,016,961	31.2%
Emerald shiner		3,220,050	232,316	91,377	92,851				3,636,594	28.2%
Round goby		1,554,586	480,568						2,035,154	15.8%
Logperch		1,328,768							1,328,768	10.3%
White bass		993,216	104,588						1,097,805	8.5%
Walleye		499,799							499,799	3.9%
Freshwater drum		139,239	16,303						155,542	1.2%
White perch		34,871	23,581						58,452	0.5%
Bluntnose minnow			23,228						23,228	0.2%
Mottled sculpin			23,228						23,228	0.2%
Notropis spp.		17,405							17,405	0.1%
Total	0	11,749,983	927,394	122,709	92,851	0	0	0	12,892,936	100.0%

APPENDIX 3
Estimated Daily Entrainment of Fish Eggs at Bay Shore Power Plant (May 2005 – May 2006)

Event No.	Date	Species	Bayshore: Eggs Collected			Volume Filtered (m ³)	Eggs per 1,000 m ³			Flow MGD	Flow 1,000 m ³	Bayshore: Eggs per day		
			Live	Dead	Total		Live	Dead	Total			Live	Dead	Total
	12-May-05	Catostomidae	0	2	2	399	0.0	5.0	5.0	561.6	2,126	0	10,652	10,652
	12-May-05	Unidentifiable	2	172	174	399	5.0	430.9	435.9	561.6	2,126	10,652	916,029	926,681
1	12-May-05	Daily Total	2	174	176	399	5.0	435.9	440.9	561.6	2,126	10,652	926,681	937,332
	16-May-05	Unidentifiable	0	4	4	350	0.0	11.4	11.4	561.6	2,126	0	24,328	24,328
2	16-May-05	Daily Total	0	4	4	350	0.0	11.4	11.4	561.6	2,126	0	24,328	24,328
3	17-May-05	Daily Total	0	0	0	491	0.0	0.0	0.0	561.6	2,126	0	0	0
	23-May-05	Freshwater drum	0	83	83	458	0.0	181.3	181.3	561.6	2,126	0	385,510	385,510
4	23-May-05	Daily Total	0	83	83	458	0.0	181.3	181.3	561.6	2,126	0	385,510	385,510
	27-May-05	Freshwater drum	0	523	523	465	0.0	1123.7	1123.7	745.9	2,824	0	3,172,914	3,172,914
		Morone spp.	2	0	2	465	4.3	0.0	4.3	745.9	2,824	12,134	0	12,134
		Unidentifiable	0	4	4	465	0.0	8.6	8.6	745.9	2,824	0	24,267	24,267
5	27-May-05	Daily Total	2	527	529	465	4.3	1132.3	1136.6	745.9	2,824	12,134	3,197,181	3,209,315
	2-Jun-05	Catostomidae	8	0	8	378	21.2	0.0	21.2	745.9	2,824	59,806	0	59,806
		Freshwater drum	0	2,224	2,224	378	0.0	5888.4	5888.4	745.9	2,824	0	16,626,150	16,626,150
		Unidentifiable	8	0	8	378	21.2	0.0	21.2	745.9	2,824	59,806	0	59,806
6	2-Jun-05	Daily Total	16	2,224	2,240	378	42.4	5888.4	5930.8	745.9	2,824	119,613	16,626,150	16,745,762
	3-Jun-05	Freshwater drum	8	260	268	376	21.3	690.7	711.9	745.9	2,824	60,005	1,950,159	2,010,164
7	3-Jun-05	Daily Total	8	260	268	376	21.3	690.7	711.9	745.9	2,824	60,005	1,950,159	2,010,164
	6-Jun-05	Freshwater drum	0	2,796	2,796	413	0.0	6763.3	6763.3	745.9	2,824	0	19,096,271	19,096,271
8	6-Jun-05	Daily Total	0	2,796	2,796	413	0.0	6763.3	6763.3	745.9	2,824	0	19,096,271	19,096,271
	7-Jun-05	Freshwater drum	0	3,775	3,775	413	0.0	9131.7	9131.7	745.9	2,824	0	25,783,655	25,783,655
		Unidentifiable	0	64	64	413	0.0	154.8	154.8	745.9	2,824	0	437,111	437,111
9	7-Jun-05	Daily Total	0	3,839	3,839	413	0.0	9286.5	9286.5	745.9	2,824	0	26,220,766	26,220,766
10	13-Jun-05	Daily Total	0	0	0	459	0.0	0.0	0.0	745.9	2,824	0	0	0
11	17-Jun-05	Daily Total	0	0	0	457	0.0	0.0	0.0	745.9	2,824	0	0	0
	23-Jun-05	Freshwater drum	0	2	2	486	0.0	4.1	4.1	745.9	2,824	0	11,624	11,624
12	23-Jun-05	Daily Total	0	2	2	486	0.0	4.1	4.1	745.9	2,824	0	11,624	11,624
13	24-Jun-05	Daily Total	0	0	0	486	0.0	0.0	0.0	745.9	2,824	0	0	0
	27-Jun-05	Freshwater drum	0	2	2	389	0.0	5.1	5.1	745.9	2,824	0	14,504	14,504
14	27-Jun-05	Daily Total	0	2	2	389	0.0	5.1	5.1	745.9	2,824	0	14,504	14,504
	28-Jun-05	Freshwater drum	0	28	28	487	0.0	57.5	57.5	745.9	2,824	0	162,445	162,445
15	28-Jun-05	Daily Total	0	28	28	487	0.0	57.5	57.5	745.9	2,824	0	162,445	162,445
16	7-Jul-05	Daily Total	0	0	0	479	0.0	0.0	0.0	745.9	2,824	0	0	0
17	8-Jul-05	Daily Total	0	0	0	474	0.0	0.0	0.0	745.9	2,824	0	0	0

Individual estimates may not add to totals due to rounding.

APPENDIX 8
Diel Distribution of Larval and Entrainable Juvenile Fish Entrained at
Bay Shore Power Plant (May 2005 – May 2006)

Date	Total Larvae/Juveniles		Sample Volume		Mean Density (No. per 1,000 m ³)	
	Day	Night	Day m ³	Night m ³	Day	Night
5/12/2005	68		399		170	
5/16/2005	567		350		1,622	
5/17/2005		6504		491		13,243
5/23/2005		333		458		728
5/27/2005	352		465		756	
MAY 2005	987	6837	1214	949	813	7,206
6/2/2005		2882		378		7,101
6/3/2005	1640		376		4,357	
6/6/2005	1772		413		4,286	
6/7/2005		14240		413		34,445
6/13/2005		78504		459		171,174
6/17/2005	1776		457		3,885	
6/23/2005		1849		496		3,806
6/24/2005	133		486		274	
6/27/2005	112		389		288	
6/28/2005		906		487		1,862
JUN 2005	5433	98181	2122	2222	2,560	44,181
7/7/2005		53		479		111
7/8/2005	13		474		27	
7/11/2005		9		281		32
7/12/2005	5		465		11	
7/21/2005	1		486		2	
7/22/2005		5		496		10
7/28/2005	3		525		6	
7/29/2005		3		521		6
JUL 2005	22	70	1950	1767	11	40
8/1/2005	5		487		10	
8/2/2005		8		487		16
8/9/2005	3		439		7	
8/12/2005				219		
8/15/2005	1		454		2	
8/18/2005				NA		
AUG 2005	9	8	1379	706	7	11
9/2/2005	1		524		2	
9/11/2005				456		0
SEP 2005	1	0	524	456	2	0
3/19/2006			491		0	
3/25/2006				483		0
3/28/2006			460		0	
3/31/2006				488		0
MAR 2006	2	0	1475	971	1	0
4/3/2006			463		0	
4/7/2006				489		0
4/9/2006	1		509		2	
4/14/2006				458		0
4/17/2006				488		0
4/20/2006	114		489		233	
4/24/2006		129				
4/26/2006	113		491		230	
APR 2006	228	129	1952	1435	117	90
5/4/2006	142		484		293	
5/6/2006		177		471		376
5/8/2006		921		473		1,946
5/12/2006	5884		469		12,554	
MAY 2006	6026	1098	953	944	6,323	1,163

Table 16. Annual Number of Fish Impinged at Bay Shore Power Plant (May 2005 – December 2006)

Species	Bayshore - Annual Number of Impinged Fish												Total	% of Total
	Jan-06	Feb-06	Mar-06	Apr-06	May-05/06	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05/06	Nov-05/06	Dec-05/06		
Emerald shiner	2,284,338	1,612,578	6,659,892	3,543,633	595,203	618,371	42,216	42,567	139,778	1,011,807	3,967,719	3,541,376	24,090,877	52.3%
Glizaid shad	841,949	312,631	959,327	343,786	6,797	66,329	1,054,323	189,086	463,612	5,555,938	841,846	3,687,450	14,313,113	31.1%
White perch	17,052	5,046	8,703	23,093	49,640	141,023	1,127,358	620,414	423,310	1,180,641	1,090,587	212,397	4,769,163	10.4%
White bass	486		2,778	5,740	1,624	216,670	1,300,298	45,596	15,570	2,985	1,453		1,593,190	3.5%
Spottail shiner	1,891	702	20,670	51,350	10,473	5,127	65,859	116,250	21,522	9,788	3,836	5,840	319,326	0.7%
Freshwater drum	760	836	745	40,154	25,906	12,826	10,756	78,740	23,383	16,208	5,860	533	225,706	0.5%
Trout-perch	326		20,336	30,366	63,210	11,801	2,015	20,570	8,570	1,515	1,560		159,279	0.3%
Yellow perch	868		1,340	3,649	1,770	1,016	351	974	714	760	111,310	653	123,405	0.3%
Round goby	326		744	2,177	5,862	19,707	16,876	32,361	8,545	5,295	648	1,375	93,918	0.2%
Walleye			645	2,927	1,890	67,861	2,653	118	421	174	1,134		77,812	0.2%
Channel catfish		789	372	14,960	4,520	4,173	10,994	12,106	9,407	16,373	3,431	324	77,469	0.2%
Logperch		294		158	353	1,244	11,543	24,298	1,825	11,216	407	209	51,547	0.1%
Sand shiner			744	20,453	1,915								32,112	0.1%
Bluegill	868		1,936	2,640	676	309	123	816	162	10,287	4,290	995	23,103	0.1%
Brook silverside	760	511	596	977				10,586		391	1,215	5,503	20,538	0.04%
Rainbow smelt		351									4,611	6,510	11,472	0.02%
Silver chub		246		158	2,383	771	1,851	4,278	1,015				10,703	0.02%
Common carp				1,922	626	3,920	2,097		106				8,573	0.02%
Brown bullhead	434	550	1,488	4,409	260		123			116	68		7,448	0.02%
Octfish	760			158	255					1,100	1,927		4,571	0.01%
Smallmouth bass	326	256			130				432	3,081	221		4,445	0.01%
Pumpkinseed			224	1,159	380	93		293	741	444			3,333	0.01%
Largemouth bass				539		307	361	122	270	72	1,330		3,031	0.01%
Bluntnose minnow				126	255	201	1,727			48			2,357	0.01%
Orangespotted sunfish			372	750	105	108	123		162				1,621	0.004%
Shorthead rockhorse				630						660	265		1,555	0.003%
Quillback		294		693	223			171		48			1,430	0.003%
Rockhorse				598	626	182							1,315	0.003%
White crappie	434				130		237				181	324	1,306	0.003%
Tadpole madtom			372	284					486		130		1,272	0.003%
Yellow bullhead			744	382			123						1,249	0.003%
White sucker			595	252						116		209	1,172	0.003%
Fathead minnow						108	617		270				995	0.002%
Black rockhorse										826			826	0.002%
Central stoneroller										815			815	0.002%
Spottail shiner						300			432				741	0.002%
Black crappie				126								419	545	0.001%
Black bullhead		256			130					72			458	0.001%
Northern pike			224								197		421	0.001%
Golden shiner					186	108		122					416	0.001%
Green sunfish							123					260	384	0.001%
Black darter			372										372	0.001%
Channel darter								342					342	0.001%
Stonescat madtom					125			171					296	0.001%
Bigmouth buffalo				158			123						281	0.001%
Alawits											270		270	0.001%
Lepomis spp.								171					171	<0.001%
Western banded killifish								171					171	<0.001%
Flathead catfish				158									158	<0.001%
Silver lamprey				152									152	<0.001%
Creek chub					130								130	<0.001%
Northern redbfin shiner											130		130	<0.001%
Sauger											128		128	<0.001%
Rainbow trout						93							93	<0.001%
Steelhead trout						93							93	<0.001%
Total	3,151,575	1,935,340	7,683,592	4,116,642	775,474	1,175,648	3,653,593	1,100,434	1,108,736	7,930,777	6,034,029	7,464,166	46,030,006	100.0%

Individual estimates may not add to totals due to rounding.

Table 17. Annual Weight (kg) of Fish Impinged at Bay Shore Power Plant (May 2005 – December 2006)

Species	Bayshore - Annual Weight of Impinged Fish (kg)												Total	% of Total
	Jan-06	Feb-06	Mar-06	Apr-06	May-05/06	Jun-06	Jul-05	Aug-05	Sep-05	Oct-05/06	Nov-05/06	Dec-05/06		
Gizzard shad	17,231	4,459	16,364	6,840	509	93	786	576	2,348	49,095	9,315	47,839	156,350	57.8%
Emerald shiner	5,194	2,663	12,400	6,367	1,847	1,766	80	31	250	1,575	8,086	6,556	46,814	17.3%
White perch	101	29	228	3,056	6,689	641	950	1,398	1,868	7,294	6,081	1,241	30,476	11.3%
Walleye			539	2,213	10,503	360	67	40	21	131	743		14,625	5.4%
Freshwater drum	272	90	16	3,353	3,071	1,480	37	717	367	478	274	109	10,263	3.8%
White bass	154		793	544	307	148	662	92	77	78	238		3,090	1.1%
Yellow perch	6		234	184	112	49	25	115	46	39	782	56	1,648	0.6%
Channel catfish		7.4	1	559	157	104	149	50	82	181	22	8	1,386	0.5%
Trout-perch	2		251	182	332	63	6	23	19	6	5		888	0.3%
Spottail shiner	10	10	131	287	28	8	81	106	42	45	34	39	823	0.3%
White sucker			37.8	4						4			240	0.2%
Redhorse				2	557	0.182							559	0.2%
Smallmouth bass	286	3			27				9	43	27		396	0.1%
Goldfish	7		20	43	7					175	20		272	0.1%
Northern pike			82							0	123		205	0.1%
Silver chub		8		4	116	52	9	4	4	0	0		198	0.1%
Shorthead redhorse				9						123	44		176	0.1%
Largemouth bass				78		0.307	1	2	2	1	92		176	0.1%
Round goby	0.326		2	7	11	39	35	40	17	16	2	3	174	0.1%
Brown bullhead	10	10	36	86	16		0.247			4	10		171	0.1%
Common carp				38	99	2	2			3			143	0.1%
Black redhorse										134			134	0.05%
Sauger										0	123		123	0.05%
Bigmouth buffalo				97			0.123			0	0		97	0.04%
Pumpkinseed			13	28	10	1		9	19	6	0		85	0.03%
Logperch		0.294	1	1	1	1	11	12	5	38	0	1	72	0.03%
Bluegill	1		3	17	7,109	2	2	1	0.324	18	5	1	57	0.02%
Cutback		2		29	16			2		0.096			48	0.02%
Yellow bullhead			9	16			0.123						25	0.01%
Black crappie				0.252								23	23	0.01%
Brook silverside	1	1	1	1	1			10		0.275	1	6	21	0.01%
Sand shiner			1	19	1								21	0.01%
Black bullhead		5			7					4			16	0.01%
Central stoneroller										16			16	0.01%
Orangespotted sunfish			10	2	1	0.108	1		3				16	0.01%
Silver Lamprey				15									15	0.01%
White crappie	1				1		0.176				0.311	10	13	0.005%
Rainbow smelt		0.351									3	7	10	0.004%
Rainbow trout						8							8	0.003%
Steelhead trout						8							8	0.003%
Tadpole madtom			2	1					1		0.391		4	0.002%
Golden shiner					0.279	3		0.122					4	0.001%
Stoneroll madtom					3			1					4	0.001%
Alowife											3		3	0.001%
Green sunfish							0.123				3		3	0.001%
Bluntnose minnow				0.126	0.380	0.309	2			0.096			3	0.001%
Black darter			2										2	0.001%
Spottail shiner						0.309			1				2	0.001%
Creek chub					1								1	<0.001%
Fathead minnow						0.108	1		0.270				1	<0.001%
Channel darter								0.342					0.342	<0.001%
Lepomis spp.								0.171					0.171	<0.001%
Western banded killifish								0.171					0.171	<0.001%
Flathead catfish				0.158									0.158	<0.001%
Northern redbelly darter											0.130		0.130	<0.001%
Total	23,276	7,354	31,516	24,061	24,437	4,830	2,905	3,232	5,184	60,405	26,935	56,132	270,296	100.0%

Individual estimates may not add to totals due to rounding.

Table 20. List of Specimens Entrained and Impinged at Bay Shore Power Plant, (May 2005 – December 2006)

Common Species Name	Scientific Name	Entrainment			Impingement
		Eggs	Larvae	Juvenile	
Alewife	<i>Alosa pseudoharengus</i>		Yes	Yes	Yes
Bigmouth buffalo	<i>Ictalurus cyprinellus</i>				Yes
Black bullhead	<i>Ameiurus melas</i>				Yes
Black crappie	<i>Pomoxis nigromaculatus</i>				Yes
Black darter	<i>Etheostoma duryi</i>				Yes
Black redhorse	<i>Moxostoma duquesnei</i>				Yes
Bluegill	<i>Lepomis macrochirus</i>				Yes
Bluntnose minnow	<i>Pimephales notatus</i>			Yes	Yes
Brook silverside	<i>Labidesthes sicculus</i>				Yes
Brown bullhead	<i>Ameiurus nebulosus</i>				Yes
Burbot ¹	<i>Lota lota</i> ¹		Yes ¹		
Central stoneroller	<i>Campestris anomatum</i>				Yes
Channel catfish	<i>Ictalurus punctatus</i>		Yes		Yes
Channel darter ²	<i>Percina capetani</i> ²				Yes ²
Common carp	<i>Cyprinus carpio</i>		Yes		Yes
Creek chub	<i>Semotilus atromaculatus</i>				Yes
Emerald shiner	<i>Notropis atherinoides</i>		Yes	Yes	Yes
Fathead minnow	<i>Pimephales promelas</i>				Yes
Flathead catfish	<i>Pylodictis olivaris</i>				Yes
Freshwater drum	<i>Aplodinotus grunniens</i>	Yes	Yes	Yes	Yes
Gizzard shad	<i>Dorosoma cepedianum</i>		Yes	Yes	Yes
Golden shiner	<i>Notemigonus crysoleucas</i>				Yes
Goldfish	<i>Carassius auratus</i>		Yes		Yes
Grass pickerel	<i>Esox americanus</i>		Yes		
Green sunfish	<i>Lepomis cyanellus</i>				Yes
Lake whitefish ¹	<i>Coregonus clupeaformis</i> ¹		Yes ¹		
Largemouth bass	<i>Micropterus salmoides</i>				Yes
Logperch	<i>Percina caprodes</i>		Yes	Yes	Yes
Mottled sculpin	<i>Cottus bairdi</i>			Yes	
Northern pike	<i>Esox lucius</i>				Yes
Redfin shiner	<i>Lythrurus umbratilis</i>				Yes
Orangespotted sunfish	<i>Lepomis humilis</i>				Yes
Pumpkinseed	<i>Lepomis gibbosus</i>				Yes
Quillback	<i>Carpodes cyprinus</i>				Yes
Rainbow smelt	<i>Osmerus mordax</i>		Yes	Yes	Yes
Rainbow trout	<i>Oncorhynchus mykiss</i>				Yes
Redhorse	<i>Moxostoma</i> spp.				Yes
Round goby	<i>Neogobius melanostomus</i>			Yes	Yes
Sand shiner	<i>Notropis stramineus</i>				Yes
Sauger	<i>Sander canadensis</i>				Yes
Shorthead redhorse	<i>Moxostoma macrolepidotum</i>				Yes
Silver chub	<i>Machyobopsis storeriana</i>				Yes
Silver lamprey	<i>Ichthyomyzon unicuspis</i>				Yes
Smallmouth bass	<i>Micropterus dolomieu</i>				Yes
Spotfin shiner	<i>Cyprinella spiloptera</i>				Yes
Spottail shiner	<i>Notropis hudsonius</i>		Yes		Yes
Steelhead trout	<i>Oncorhynchus mykiss</i>				Yes
Stonecat	<i>Noturus flavus</i>				Yes
Tadpole madtom	<i>Noturus gyrinus</i>				Yes
Trout-perch	<i>Percopsis omiscomaycus</i>		Yes		Yes
Walleye	<i>Sander vitreus</i>		Yes	Yes	Yes
Western banded killifish ³	<i>Fundulus diaphanus menona</i> ³				Yes ³
White bass	<i>Morone chrysops</i>		Yes	Yes	Yes
White crappie	<i>Pomoxis annularis</i>				Yes
White perch	<i>Morone americana</i>		Yes	Yes	Yes
White sucker	<i>Catostomus commersoni</i>		Yes		Yes
Yellow bullhead	<i>Ameiurus natalis</i>				Yes
Yellow perch	<i>Perca flavescens</i>		Yes		Yes
Common Genus Name	Scientific Name				
Crappies	<i>Pomoxis</i> spp.		Yes		
Shiners	<i>Notropis</i> spp.		Yes	Yes	
Sunfishes	<i>Lepomis</i> spp.		Yes		Yes
Temperate basses	<i>Morone</i> spp.	Yes	Yes		
Common Family Name	Scientific Name				
Carp and minnows	Cyprinidae		Yes		
Perches	Percidae		Yes		
Suckers	Catostomidae	Yes	Yes		
Sunfishes	Centrarchidae		Yes		

¹ Identified by the Ohio Department of Natural Resources as a species of concern.

² Identified by the Ohio Department of Natural Resources as a threatened species.

³ Identified by the Ohio Department of Natural Resources as an endangered species.

APPENDIX 10 (cont'd)
Estimated Monthly Impingement of Fish at Bay Shore Power Plant
(May 2005 – December 2006)

Species	Life Stage	Bayshore: Estimated Monthly Impingement					
		Live-Healthy	Live-Stressed	Recently Dead	Long Dead	Total #	Weight (kg)
Bluegill	YOY(<100mm)		93	216		309	1.697
Bluntnose minnow				201		201	0.309
Channel catfish	Adult		565			565	81.584
Channel catfish	YOY(<150mm)		3,284	123	201	3,608	22,544
Common carp	YOY(<150mm)		3,829	91		3,920	2,014
Emerald shiner			383,382	127,124	107,866	618,371	1,765,553
Fathead minnow			108			108	0.108
Freshwater drum	Adult		3,996	755	216	4,967	1,006,208
Freshwater drum	YOY(<200mm)		6,394	1,356	108	7,859	473,415
Gizzard shad	Adult		123		123	245	75,109
Gizzard shad	YOY(<200mm)		65,902	182		66,083	17,807
Golden shiner			108			108	3.456
Largemouth bass	YOY(<150mm)		307			307	0.307
Logperch			1,061	93	91	1,244	1,244
Orangespotted sunfish				108		108	0.108
Pumpkinseed			93			93	0.926
Rainbow trout			93			93	7.776
Redhorse			182			182	0.182
Round goby			17,832	1,783	93	19,707	39,489
Silver chub			432	339		771	52,370
Spotfin shiner			216		93	309	0.309
Spottail shiner			3,615	1,512		5,127	8,250
Steelhead trout			93			93	7.776
Trout-perch			9,998	1,804		11,801	62,863
Walleye	Adult		740	324		1,064	325,509
Walleye	YOY(<200mm)		64,254	2,359	185	66,798	43,737
White bass	Adult		747			747	73,362
White bass	YOY(<150mm)		213,167	4,756		217,923	74,360
White perch	Adult		3,448	1,742	108	5,298	589,388
White perch	YOY(<150mm)		133,554	3,070		136,624	51,950
Yellow perch	Adult		492			492	37,323
Yellow perch	YOY(<150mm)		525			525	11,541
Jun-05		0	918,630	147,936	109,082	1,175,648	4,838,572

Individual estimates may not add to totals due to rounding.

APPENDIX 2
Cooling Water Volumes for Bay Shore Power Plant
(April 2005 – December 2006)

Date	Cooling Water MGD	Date	Cooling Water MGD	Date	Cooling Water MGD
1-Apr-05	745.9	1-May-05	745.9	1-Jun-05	745.9
2-Apr-05	745.9	2-May-05	745.9	2-Jun-05	745.9
3-Apr-05	745.9	3-May-05	745.9	3-Jun-05	745.9
4-Apr-05	745.9	4-May-05	745.9	4-Jun-05	745.9
5-Apr-05	745.9	5-May-05	745.9	5-Jun-05	745.9
6-Apr-05	745.9	6-May-05	745.9	6-Jun-05	745.9
7-Apr-05	745.9	7-May-05	745.9	7-Jun-05	745.9
8-Apr-05	745.9	8-May-05	745.9	8-Jun-05	745.9
9-Apr-05	745.9	9-May-05	745.9	9-Jun-05	745.9
10-Apr-05	745.9	10-May-05	745.9	10-Jun-05	745.9
11-Apr-05	745.9	11-May-05	745.9	11-Jun-05	745.9
12-Apr-05	745.9	12-May-05	561.6	12-Jun-05	745.9
13-Apr-05	745.9	13-May-05	561.6	13-Jun-05	745.9
14-Apr-05	745.9	14-May-05	561.6	14-Jun-05	745.9
15-Apr-05	745.9	15-May-05	561.6	15-Jun-05	745.9
16-Apr-05	745.9	16-May-05	561.6	16-Jun-05	745.9
17-Apr-05	745.9	17-May-05	561.6	17-Jun-05	745.9
18-Apr-05	745.9	18-May-05	561.6	18-Jun-05	745.9
19-Apr-05	745.9	19-May-05	561.6	19-Jun-05	745.9
20-Apr-05	745.9	20-May-05	561.6	20-Jun-05	745.9
21-Apr-05	745.9	21-May-05	561.6	21-Jun-05	745.9
22-Apr-05	745.9	22-May-05	561.6	22-Jun-05	745.9
23-Apr-05	745.9	23-May-05	561.6	23-Jun-05	745.9
24-Apr-05	745.9	24-May-05	561.6	24-Jun-05	745.9
25-Apr-05	745.9	25-May-05	745.9	25-Jun-05	745.9
26-Apr-05	745.9	26-May-05	745.9	26-Jun-05	745.9
27-Apr-05	745.9	27-May-05	745.9	27-Jun-05	745.9
28-Apr-05	745.9	28-May-05	745.9	28-Jun-05	745.9
29-Apr-05	745.9	29-May-05	745.9	29-Jun-05	745.9
30-Apr-05	745.9	30-May-05	745.9	30-Jun-05	745.9
		31-May-05	745.9		

Table 1
Source of Cooling Water for Bay Shore Power Plant

Date	Maumee River Discharge *		Bay Shore Cooling Water		Source of Cooling Water	
	Monthly Mean cfs	Million Gallons	Million Gallons	% of Maumee River	Maumee River	Maumee Bay
Apr-05	7,542	146,235	22,377	15%	√	
May-05	3,218	64,475	20,727	32%	√	
Jun-05	1,104	21,406	22,377	105%	96%	4%
Jul-05	1,569	31,436	22,386	71%	√	
Aug-05	487	9,759	22,178	227%	44%	56%
Sep-05	2,028	39,322	22,377	57%	√	
Oct-05	1,155	23,141	23,123	100%	√	
Nov-05	3,955	76,685	22,377	29%	√	
Dec-05	8,567	171,646	23,123	13%	√	
Jan-06	14,260	285,710	23,123	8%	√	
Feb-06	9,779	176,969	20,885	12%	√	
Mar-06	6,401	128,249	23,123	18%	√	
Apr-06	4,688	90,898	22,377	25%	√	
May-06	10,230	204,966	23,123	11%	√	
Jun-06	3,422	66,351	22,377	34%	√	
Jul-06	4,362	87,396	23,123	26%	√	
Aug-06	1,192	23,883	23,123	97%	√	
Sep-06	1,256	24,353	NA	NA	NA	NA
Oct-06	6,782	135,883	23,123	17%	√	
Nov-06	6,299	122,134	22,377	18%	√	
Dec-06	15,480	310,154	23,123	7%	√	
Jan-07	23,770	476,250	NA	NA	NA	NA
Feb-07	1,216	22,006	NA	NA	NA	NA
Mar-07	17,240	345,417	NA	NA	NA	NA
Apr-07	9,840	190,792	NA	NA	NA	NA
May-07	3,750	75,134	NA	NA	NA	NA
Jun-07	565.6	10,967	NA	NA	NA	NA
Jul-07	440.6	8,828	NA	NA	NA	NA
Aug-07	11,740	235,220	NA	NA	NA	NA
Sep-07	2,623	50,859	NA	NA	NA	NA

* Maumee River at Waterville Ohio (USGS 0419350)

Figure 2. Maumee River Discharge Versus Fish Impingement

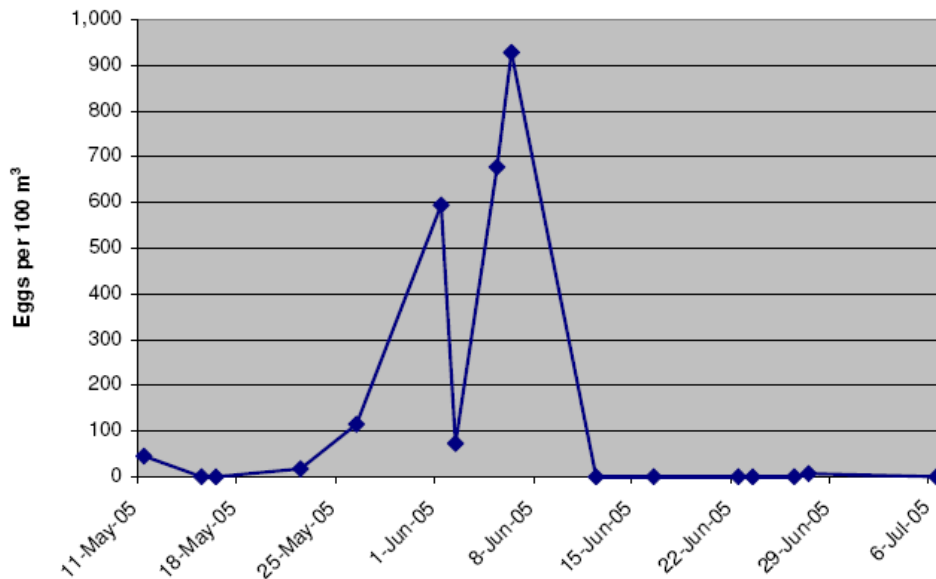
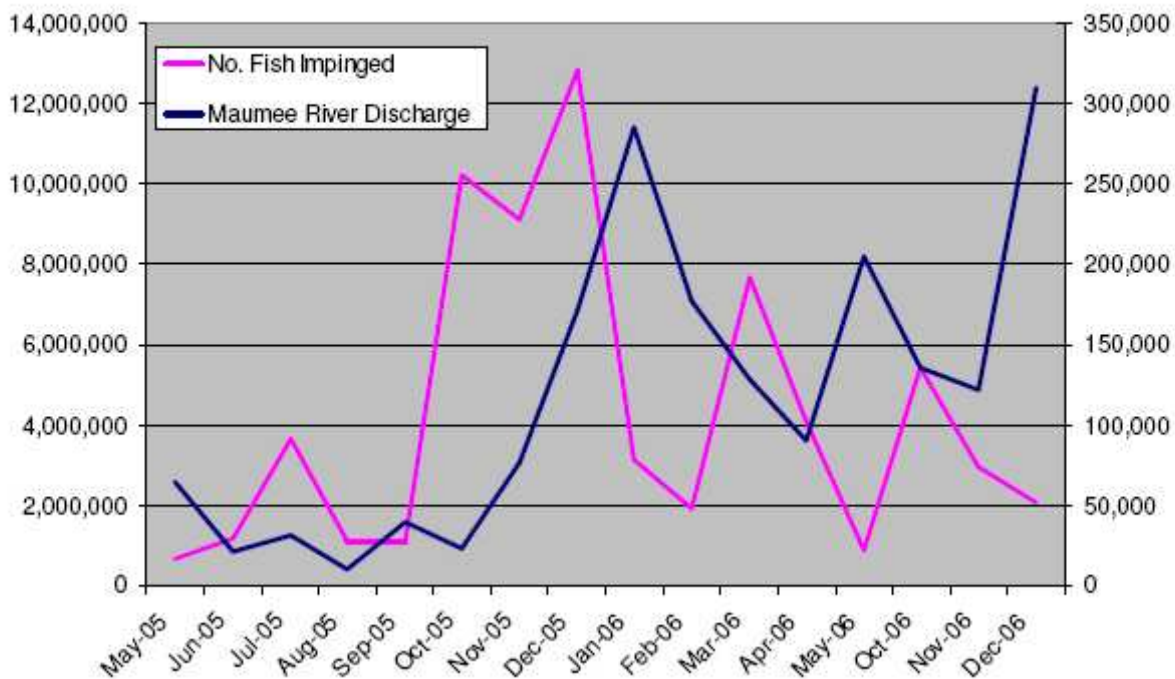


Figure 6. Densities of Fish Eggs at Bay Shore Intake Canal

Figure 7
 Estimated Number of Fish Eggs Entrained each Month at Bay Shore Power Plant
 (May 2005 – May 2006)

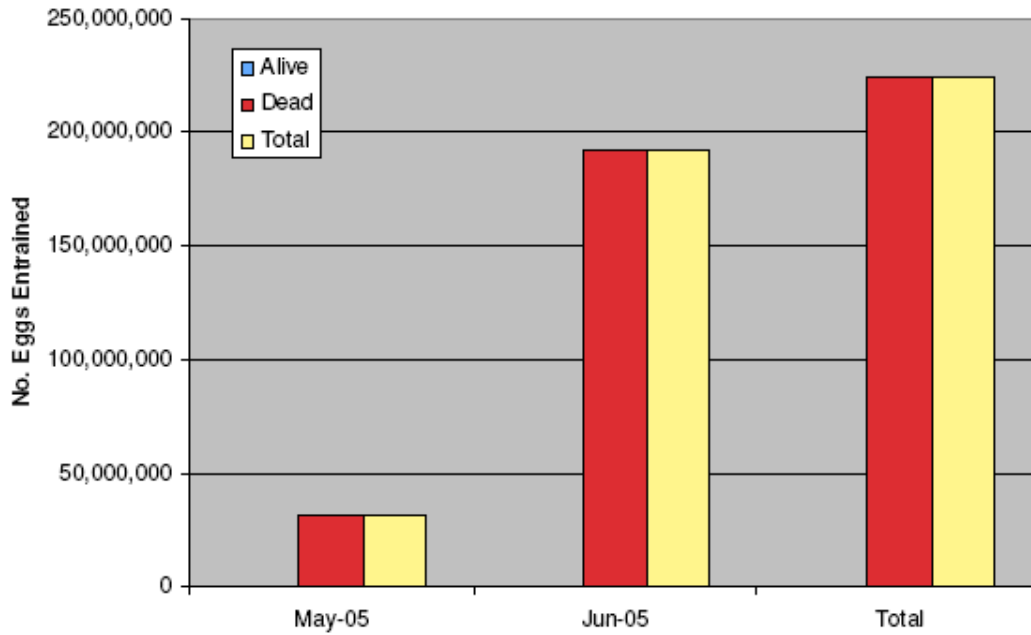


Figure 11. Bay Shore Larval Fish Entrainment: 2005-2006 versus 1976-1977

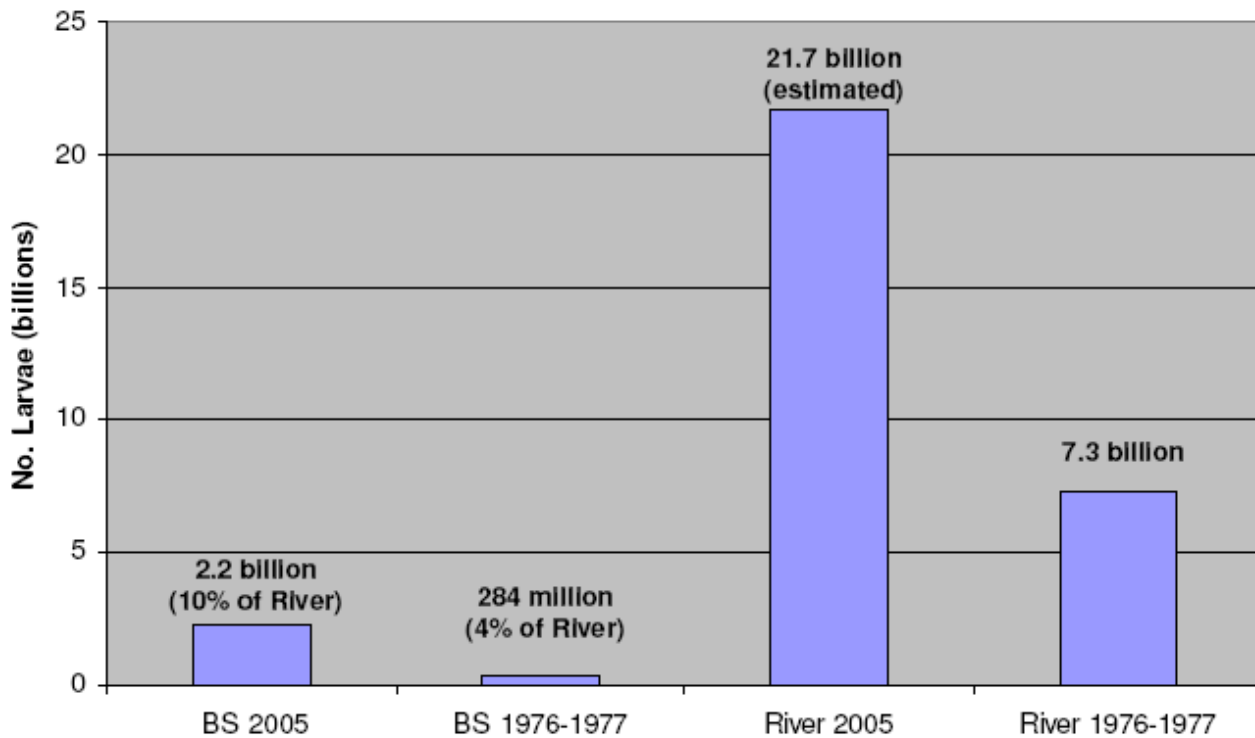


Figure 13
 Estimated Number of Entrained Juvenile Fish Entrained each Month at Bay Shore Power Plant
 (May 2005 – May 2006)

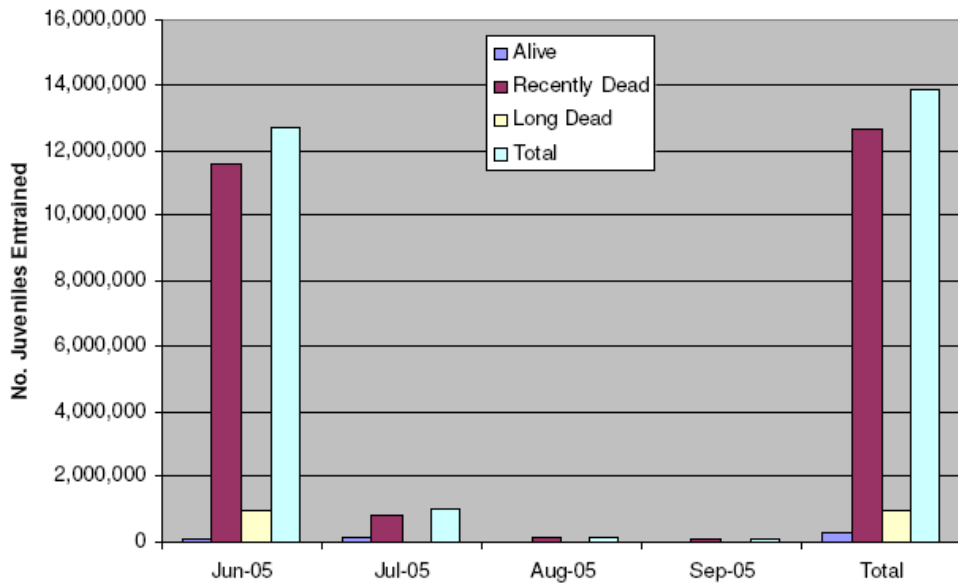


Figure 15
 Total Extrapolated Number of Fish Impinged on a Monthly Basis at Bay Shore Power Plant
 (April 2005 – April, 2006)

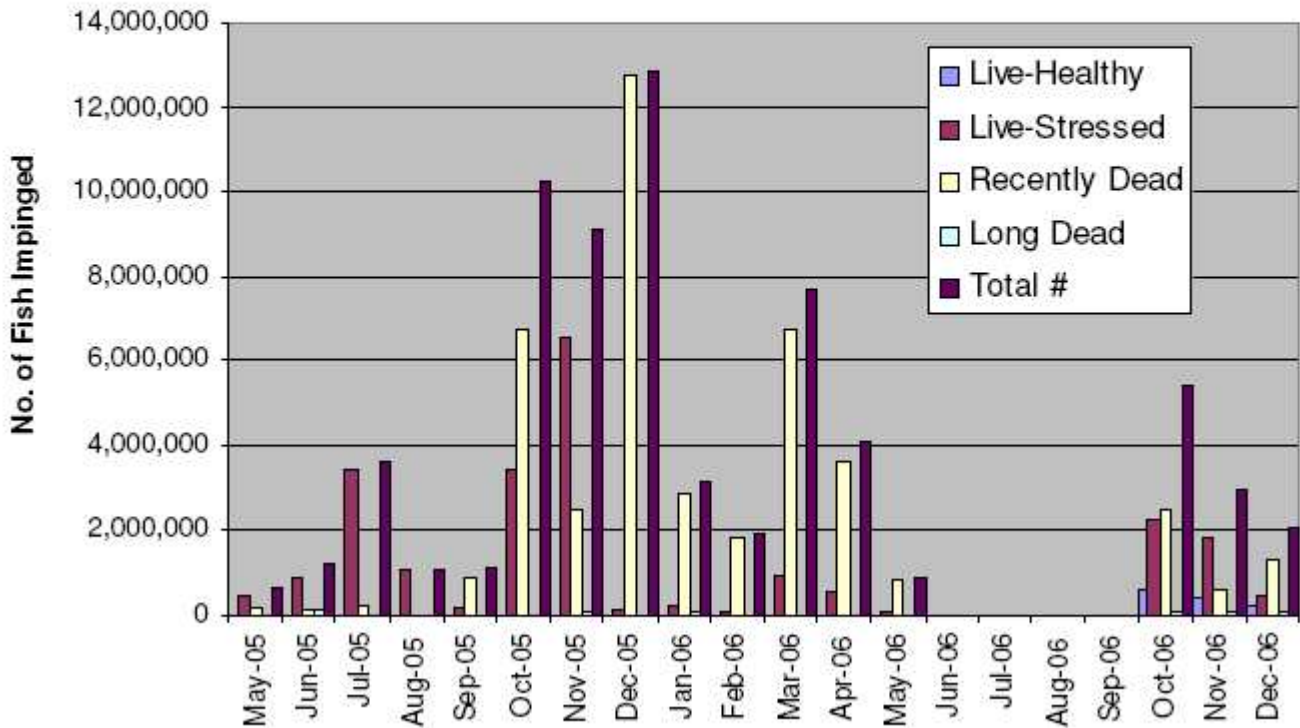


Figure 16
Comparison of Impingement Levels at Bay Shore
(2005 versus 2006)

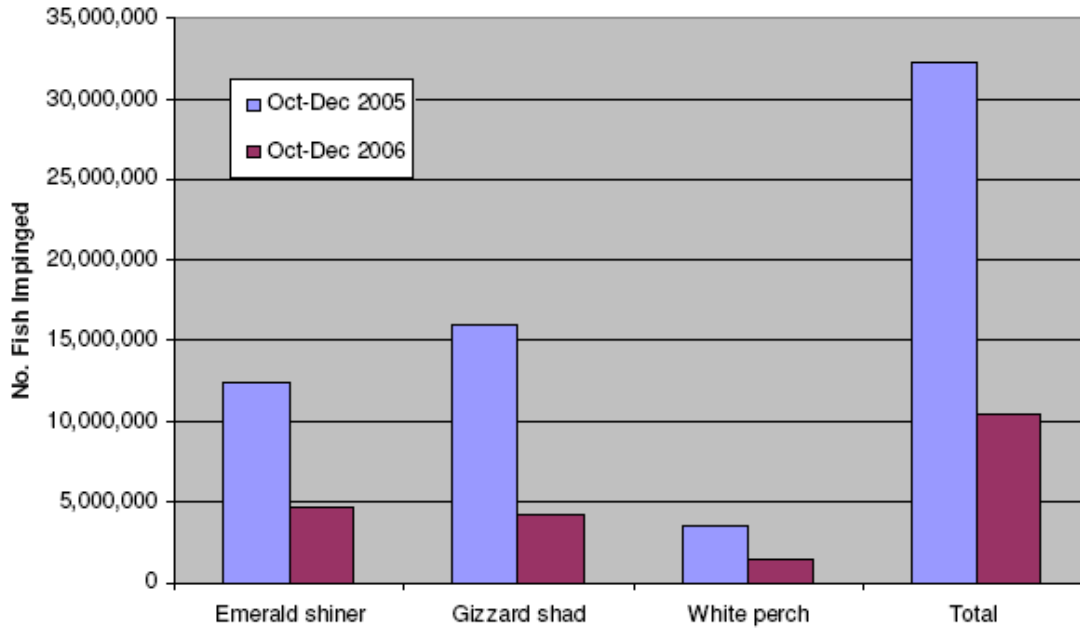


Figure 17. First-Order Model of Factors Contributing to Fish Impingement at Maumee River Power Generating Facilities (Smith and Cooper, 1976)

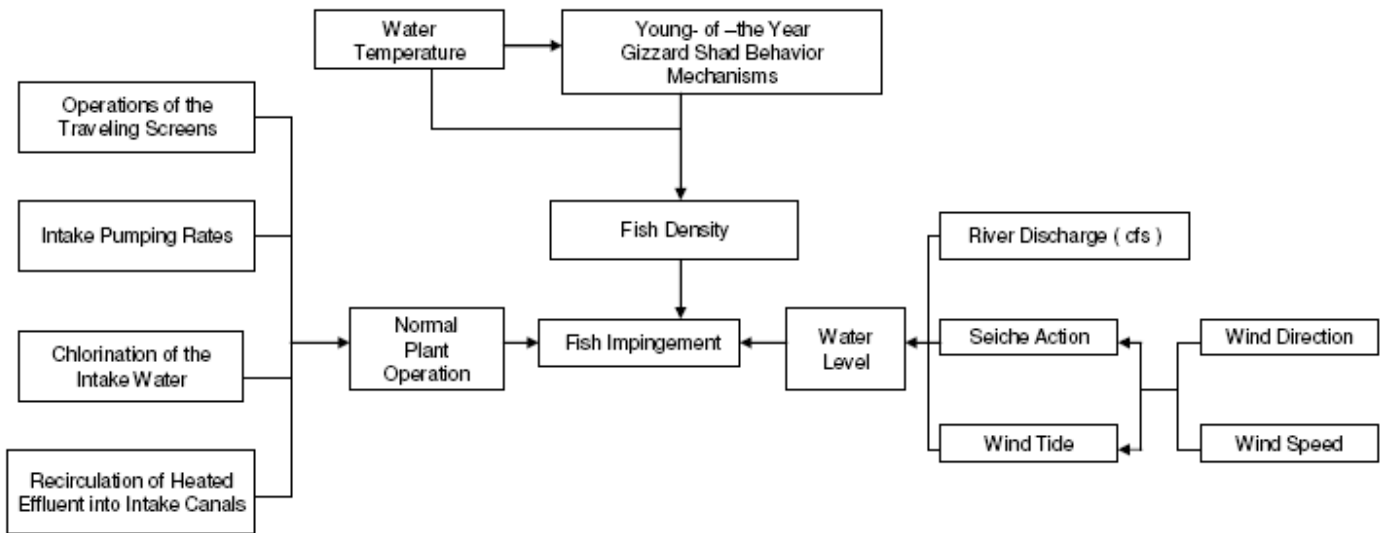


Figure 18
Comparison of Fish Impingement Levels at Bay Shore Power Plant
(1976-1977 versus 2005-2006)

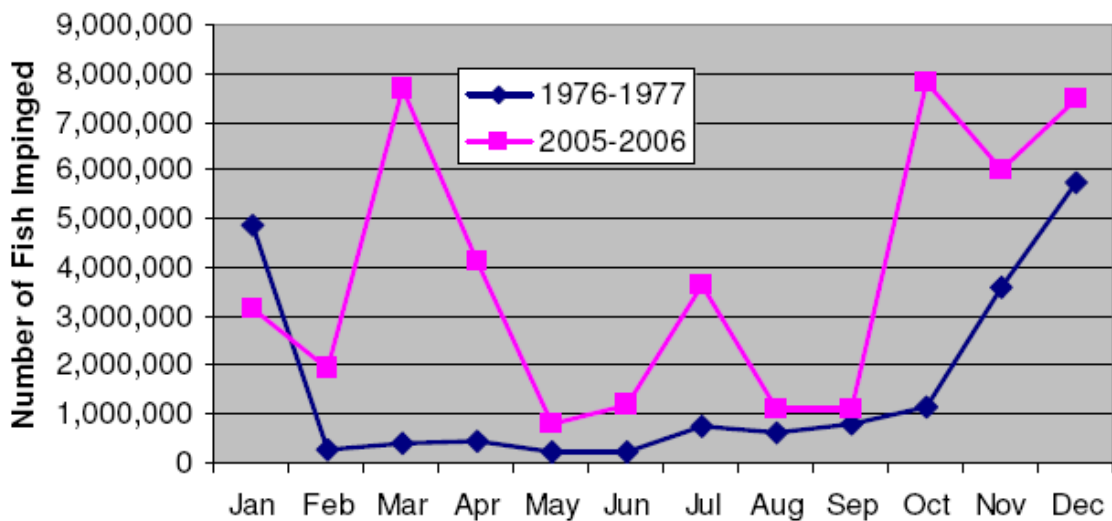


Table 2. Entrainment Sampling Schedule for Bay Shore Power Plant

Month	Number of Entrainment Events/Month	Samples per Event	Samples per month
May, 2005	5	10	50
June, 2005	10	10	100
July, 2005	8	10	80
August, 2005	6	10	60
September, 2005	2	10	20
March, 2006	4	10	40
April, 2006	8	10	80
May, 2006	4	10	40
	Total Events = 47		Total Samples = 470

Table 3. Impingement Sampling Schedule for Bay Shore Power Plant

Month	Number of Impingement Events
May, 2005	5
June, 2005	10
July, 2005	8
August, 2005	8
September, 2005	10
October, 2005	10
November, 2005	8
December, 2005	3
January, 2006	4
February, 2006	4
March, 2006	7
April, 2006	8
May, 2006	4
October, 2006	5
November, 2006	8
December, 2006	2
TOTAL	104

Table 8
Annual Estimate of Fish Larvae Entrained at Bay Shore Power Plant
(May 2005 – May 2006)

Species	Bay Shore - Annual Number of Entrained Larvae								
	May 05/06	Jun-05	Jul-05	Aug-05	Sep-05	Mar-06	Apr-06	Total	% of Total
Freshwater drum		977,312,351	79,788	34,772				977,426,912	43.5%
Rainbow smelt/Clupeidae	119,920,367	415,780,097	519,964				45,406	536,265,835	23.9%
Unidentifiable	38,613,971	426,336,716	165,664	66,103			762,596	465,945,050	20.7%
Morone spp.	100,211,180	37,242,661	95,920					137,549,760	6.1%
Logperch	21,814,479	8,600,492					2,348,669	32,763,640	1.5%
White sucker	232,238	28,964,338						29,196,575	1.3%
Emerald shiner		18,826,286	175,288					19,001,574	0.8%
White bass		17,816,675	23,581					17,840,256	0.8%
Walleye	5,820,753	793,968					1,543,107	8,157,828	0.4%
Cyprinidae	449,942	7,010,821	23,581					7,484,343	0.3%
Notropis spp.		4,707,966						4,707,966	0.2%
Yellow perch	919,867	1,258,759	63,356	62,662			875,848	3,180,492	0.1%
Percidae	568,882						1,731,756	2,300,638	0.1%
Common carp/Goldfish	36,890	2,018,974	87,326					2,143,190	0.1%
Catostomidae	638,744							638,744	0.03%
Trout-perch		655,666						655,666	0.03%
Walleye/Yellow perch							616,543	616,543	0.03%
White perch		488,198	23,581					511,779	0.02%
Lepomis spp.		17,436		250,649				268,084	0.01%
Grass pickerel	92,453						45,328	137,782	0.01%
Pomoxis spp.		180,015						180,015	0.01%
Burbot	84,256							84,256	0.004%
Spottail shiner		56,596	23,228					79,825	0.004%
Channel catfish			70,390					70,390	0.003%
Centrarchidae	21,064							21,064	0.001%
Lake whitefish							20,814	20,814	0.001%
Total	289,425,086	1,948,068,015	1,351,666	414,186	0	0	7,990,066	2,247,249,020	100.0%

Individual estimates may not add to totals due to rounding.