

**Impingement of Fishes at the Indianapolis  
Power and Light Company Generating Station  
on the White River at Petersburg, Indiana**

JOHN O. WHITAKER, JR.  
Department of Life Sciences  
Indiana State University  
Terre Haute, Indiana 47809

**Introduction**

Impingement is the lodging of organisms on the protective screens at the inflow channels of electric generating plants. The screens function to keep unwanted items out of the mechanism of the plant, and are automatically cleaned periodically by water running through them. The "impinged" items were previously allowed to move out a trough and back into the river, but now are removed. Impingement has caused concern as a possible hazard to fish at generating plants.

This work was part of a study of the effects of the Indianapolis Power and Light Company generating station on the White River at Petersburg, Indiana (Proffitt, 1969; Proffitt and Benda, 1971; Whitaker and Schlueter, 1973; Whitaker, Schlueter and Tieben, 1977). The objective of this phase of the work was to determine the extent of impingement of fish at the generating plant.

**Materials and Methods**

To determine effects of impingement on fish of the White River at the IPALCO plant, seines were placed across the impingement outflow trough and all fish were collected during extended sampling periods. The first seine was a 1/4-in. nylon mesh, and the second was of 1/8-in. nylon mesh. Both were heavily weighted. The nets were in position for 25-35 hours per collecting trip, and were checked periodically. Accumulated debris was removed and examined for the presence of fish, mollusks, and other large animal life. Early in the study, the fish were identified and numbers of the various species were simply counted, while later, they were assessed by size class. Also, during the latter part of the study, notation was made as to whether the fish were dead, alive, or in various stages of decomposition when collected. It was assumed that the "fresh" fish had been alive when impinged, but that the rotting fish had simply floated into the plant entrance after death. However, some of the fresh fish may have been dead when impinged, as dead fish can remain in fresh condition for several days in cold weather. On January 23-25, 1976, a sample was taken before, during and after deicing, to see if that process had any notable effect on the fishes impinged.

Eight reptiles were taken in the impingement sample, but are not included in the Tables. They included four map turtles, *Graptemys geographica*, three soft-shelled turtles, *Trionyx spinifer*, and one water snake, *Nerodia sipedon*.

**Results**

The total number, number per hour, and projected number per year of all species of fish taken in the impingement sample (excluding the deicing sample) are given in Table 1. These totaled 10,772 individuals. Of these, 9784 (90.8%) were gizzard shad, *Dorosoma cepedianum*, followed by *Ictalurus punctatus*, channel catfish (444, 4.1%) and *Ictiobus* sp., buffalo (149, 1.4%; young individuals of *I. niger* and *I. bubalus*). A total of 32 separate species is listed, along with some individuals identified only to genus and some unidentified fish.

TABLE 1. Numbers of fish impinged during the 1399.75 hours (58.3 days) of sampling time at the IPALCO generating plant at Petersburg, together with number per hour and projected number per year.

Species	Total	No/hr	Projected No/Year
	No.		
<i>Dorosoma cepedianum</i> —Gizzard Shad	9784	6.99	61231
<i>Ictalurus punctatus</i> —Channel Catfish	444	0.32	2779
<i>Ictiobus</i> sp.—Buffalo	149	0.11	932
<i>Aplodinotus grunniens</i> —Freshwater drum	72	0.05	451
<i>Pimephales vigilax</i> —Bullhead minnow	46	0.03	288
<i>Hybognathus nuchalis</i> —Silvery minnow	35	0.03	219
<i>Cyprinus carpio</i> —Carp	30	0.02	188
<i>Notropis spilopterus</i> —Spotfin shiner	29	0.02	181
<i>Ichthyomyzon unicuspis</i> —Silver lamprey	26	0.02	163
<i>Lepomis macrochirus</i> —Bluegill	20	0.01	125
<i>Pylodictus olivaris</i> —Flathead catfish	19	0.01	119
<i>Carpiodes carpio</i> —River carpsucker	16	0.01	100
<i>Hiodon alosoides</i> —Goldeye	14	0.01	88
<i>Lepomis cyanellus</i> —Green sunfish	13	0.01	81
<i>Micropterus punctulatus</i> —Spotted bass	8	0.01	50
<i>Pomoxis annularis</i> —White crappie	6	0.004	38
<i>Carpiodes velifer</i> —Highfin carpsucker	6	0.004	38
<i>Morone chrysops</i> —White bass	6	0.004	38
<i>Alosa chrysochloris</i> —Skipjack herring	5	0.004	31
<i>Lepomis megalotis</i> —Longear sunfish	4	0.003	25
<i>Stizostedion canadense</i> —Sauger	3	0.002	19
<i>Lepisosteus osseus</i> —Longnose gar	3	0.002	19
<i>Moxostoma</i> sp.—Redhorse sp.	3	0.002	19
<i>Hybopsis storeriana</i> —Silver chub	3	0.002	19
<i>Anguilla rostrata</i> —American eel	1	0.001	6
<i>Polyodon spathula</i> —Paddlefish	1	0.001	6
<i>Lepisosteus platostomus</i> —Shortnose gar	1	0.001	6
<i>Lepomis</i> sp.—Sunfish sp.	1	0.001	6
<i>Carpiodes cyprinus</i> —Quillback	1	0.001	6
<i>Scaphirhynchus platorhynchus</i> —Shovelnose sturgeon	1	0.001	6
<i>Carassius auratus</i> —Goldfish	1	0.001	6
<i>Ictiobus cyprinellus</i> —Bigmouth buffalo	1	0.001	6
<i>Semotilus atromaculatus</i> —Creek chub	1	0.001	6
<i>Ictiobus bubalus</i> —Smallmouth buffalo	1	0.001	6
<i>Ictalurus melas</i> —Black bullhead	1	0.001	6
Unidentified fish	17	0.01	106
Totals	10,772	7.70	67,413

Seasonal distribution of the fish is given in Table 2. It is apparent that relatively few fish are generally impinged. Sampling periods usually varied from 25 to 35 hours, and the total number of fish taken was less than 100 individuals in all but 8 of the 23 sampling periods. The largest impingement collections occurred on September 13-14, September 20-21, September 27-28, and October 11-12, 1975, when totals of 404, 7432, 875, and 476 individuals were taken. Again, the great majority of these fish, totalling 8727 of the 9097 (95.9%) fish, were gizzard shad, *Dorosoma cepedianum*. These fish were mostly in the 2-4" size classes, and thus included schools of young individuals

Tables 1 and 2 include all fish taken by impingement. However, some of the fish taken in these samples were in various stages of decomposition, and thus presumably were dead before drifting through the plant intake. Table 3 gives data for live and fresh fish in the later impingement samples. The total number of fish impinged during these periods was 10,533 in 928.5 hours, or 11.37 per hour.

TABLE 2. Seasonal distribution of fish taken by impingement sampling at IPALCO generating plant at Petersburg, Indiana. Species in which at least 50 individuals were taken are summarized separately; rest are combined.

Sampling Dates	Numbers of fish					Total Fish	Total hrs.	No. fish per hr.
	<i>Dorosoma cepedianum</i>	<i>Ictalurus punctatus</i>	<i>Ictiobus</i> sp.	<i>Aplodinotus grunniens</i>	Other species			
1973-74	95	6	0	0	17	118	181	0.65
1975								
Jan 25-27	1	0	0	0	2	3	46	0.06
June 13-15	13	0	0	0	5	18	52.25	0.34
28-30	6	0	0	0	2	8	51.5	0.16
July 11-13	1	7	0	2	4	14	52	0.27
18-20	6	13	0	0	4	23	45	0.51
25-27	30	17	0	1	7	55	46.5	1.18
Aug 3-5	4	4	2	0	5	15	48.5	0.31
9-11	11	42	2	0	27	82	49	1.67
13-15	11	115	3	16	17	162	52	3.12
23-24	11	6	4	1	4	26	28	0.93
30-31	12	18	3	2	3	38	38	1.00
Sept 6-7	7	6	5	0	4	22	33	0.67
13-14	156	117	90	7	34	404	31	13.03
20-21	7265	27	23	3	24	7342	31.75	231.24
27-28	842	16	3	1	13	875	31.75	27.56
Oct. 4-5	9	0	2	0	3	14	32	0.44
11-12	464	1	0	0	11	476	32	14.88
18-19	90	1	1	0	0	92	32	2.88
25-26	42	1	1	0	3	47	31.75	1.48
Nov 1-2	195	4	0	0	2	201	32	6.28
8-9	39	4	0	0	3	46	32	1.44
15-16	341	5	3	8	4	361	32	11.28
22-23	22	1	0	11	2	36	32	1.13
Dec 21-22	16	1	0	0	1	18	30	0.60
1976								
Mar 20-21	31	14	7	8	7	67	31	2.16
Apr 24-25	11	0	0	1	8	20	32	0.63
May 1-2	14	6	0	5	14	39	46	0.85
May 8-9	7	1	0	1	12	21	31.25	0.67
15-16	7	4	0	3	26	40	32	1.25
21-22	6	2	0	0	22	30	32	0.94
28-29	2	3	0	1	7	13	32	0.41
June 5-6	11	2	0	1	7	21	32	0.66
12-13	6	0	0	0	19	25	31.5	0.79
	9784	444	149	72	323	10,772	1399.75	7.70

Of these, 3767 were partially decomposed, leaving a total of 6,766 live or fresh fish, or 7.29 per hour. Again, the few samples with large numbers of small *Dorosoma* (Fall, 1975) contribute greatly to the overall calculated numbers per hour. In the 27 samples, there were 16 samples with less than 1 live or freshly killed fish per hour, and 21 with less than 3.

Most of the fish taken in the impingement samples were relatively small, less than 6 in. total length (many were 2-4" long). Table 4 summarizes data for all fish over 6 in. long taken in the impingement sample from August 23, 1975,

TABLE 3. *Fish in varying stages of decomposition (1976), during 928.5 hours of sampling.*

1975	No. of fish	Total # dead and decaying	Hrs.	Total # of fresh fish	No/hr of live or freshly killed fish
Aug 3-5	15	10	48.5	5	0.10
9-11	82	80	49	2	0.04
13-15	162	58	52	104	2.00
23-24	26	25	28	1	0.04
30-31	38	35	38	3	0.08
Sept 6-7	22	14	33	8	0.24
13-14	404	184	31	220	7.10
20-21	7342	2989	31.75	4353	137.10
27-28	875	217	31.75	658	20.72
Oct 4-5	14	0	32	14	0.44
11-12	476	18	32	458	14.31
18-19	92	0	32	92	2.88
25-26	47	41	31.75	6	0.19
Nov 1-2	201	37	32	164	5.13
8-9	46	12	32	34	1.06
15-16	361	0	32	361	11.28
22-23	36	0	32	36	1.13
Dec 21-22	18	0	30	18	0.60
1976					
Mar 20-21	67	0	31	67	2.16
Apr 24-25	20	0	32	20	0.63
May 1-2	39	0	46	39	0.85
8-9	21	0	31.25	21	0.67
15-16	40	5	32	35	1.09
21-22	30	1	32	29	0.91
28-29	13	9	32	4	0.13
June 5-6	21	14	32	7	0.22
12-13	25	18	31.4	7	0.22
	10533	3767	928.50	6766	7.29

TABLE 4. *Size classes of fish impinged at the IPALCO generating plant at Petersburg, Indiana. (Most of the 10,274 fish taken between August 23, 1975, and June 1976 were less than 6 inches long. Fish greater than 6 inches total length are indicated here.)*

Species	Size groupings			Totals
	7-12"	13-18"	18+ "	
<i>Dorosoma cepedianum</i>	51	0	0	51
<i>Ichthyomyzon unicuspis</i>	20	0	0	20
<i>Hiodon alosoides</i>	14	0	0	14
<i>Cyprinus carpio</i>	2	7	3	12
<i>Ictalurus punctatus</i>	6	0	0	6
<i>Carpiodes carpio</i>	4	0	0	4
<i>Aplodinotus grunniens</i>	3	1	0	4
<i>Alosa chrysochloris</i>	3	0	0	3
<i>Moxostoma</i> sp.	1	1	0	2
<i>Scaphyrhynchus platorhynchus</i>	0	0	1 (24")	1
<i>Morone chrysops</i>	0	1	0	1
<i>Pomoxis annularis</i>	1	0	0	1
<i>Ictiobus bubalus</i>	0	1	0	1
<i>Lepomis macrochirus</i>	1	0	0	1
<i>Ictalurus melas</i>	1	0	0	1
	107	11	4	122

through June, 1976 (when length of impinged fish were recorded). Of the 10,274 fish taken during this period, only 122 or 1.2% of the individuals were longer than 6 in. Of these, nearly half were gizzard shad, and 20 were silver lampreys.

Another question of interest related to the effect of the deicing process (warming of the intake screens by spraying warm water into the intake just ahead of the screens) on the impingement of the fish. A combination of scheduling problems, equipment problems at the plant, and warm weather reduced the sampling when deicing was occurring to one period. This period was on January 23 to 25, 1976 (Table 5). On January 24, ambient river temperature was 4°C at the sur-

TABLE 5. *Fish taken by impingement sampling before and during deicing, Jan. 23-25, 1976, at IPALCO plant at Petersburg, Indiana.*

	21 hours		30 hours		51 hours	
	Before deicing		During deicing		Total	
	No.	No/hr	No.	No/hr	No.	No/hr
<i>Ictiobus</i> sp.	21	1.0	46	1.53	67	1.31
<i>Aplodinotus grunniens</i>	12	0.57	10	0.33	22	0.43
<i>Dorosoma cepedianum</i>	2	0.10	16	0.53	18	0.35
<i>Notropis atherinoides</i>	2	0.10	0	—	2	0.04
<i>Hybognathus nuchalis</i>	1	0.05	0	—	1	0.02
<i>Ictalurus punctatus</i>	1	0.05	11	0.37	12	0.24
<i>Morone chrysops</i>	0	—	1	0.03	1	0.02
<i>Lepomis macrochirus</i>	0	—	1	0.03	1	0.02
<i>Lepisosteus osseus</i>	0	—	1	0.03	1	0.02
Totals	39	1.86	86	2.87	125	2.45

face. The impingement sampling seines were in place for 21 hours January 23-24 before deicing occurred. A total of 39 fish was taken, or 1.86 per hour. The deicers were then turned on and impingement sampling occurred for 30 additional hours and 86 fish were taken, or 2.87 per hour. This difference was not great, but was significant ( $X^2 = 5.16$ , 1 df).

It is unfortunate that more sampling periods were not possible in 1976 when deicers were operating. Additional data are needed, but it does appear that the deicer may attract some fish that otherwise would not have been impinged.

#### Literature Cited

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