SR-14

SUMMARY OF THE OPERATION OF THE CONOWINGO DAM FISH COLLECTION FACILITY DURING THE SPRING OF 1974

by

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FISH FACILITY OPERATION REPORT 3

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INTRODUCTION

An agreement was signed between the Philadelphia Electric Company, Susquehanna Electric Company, Pennsylvania Power and Light Company, Metropolitan Edison Company, Safe Harbor Water Power Corporation, State of Maryland, Commonwealth of Pennsylvania, State of New York, and the Department of the Interior on 29 September 1970, for the implementation of a five-year program "for restoration of the American shad to the Susquehanna River". Part of the program called for construction of "fish attraction, collection and trapping devices" to determine the number of American shad (Alosa sapidissima) available that could be collected from immediately below Conowingo Dam and transported upriver and released. The Conowingo Dam Fish Collection Facility was constructed for Philadelphia Electric Company by the Arundel Corporation using conceptual plans supplied by the U. S. Department of Interior through the Susquehanna River Shad Advisory Committee.

The facility has previously been operated in 1972 and 1973 (Robbins, 1972; Foote and Robbins, 1973). Operation in 1974 was according to procedures outlined by Robbins, Kotkas and Buchanan (1974) and approved by the Operations Subcommittee of the Susquehanna River Shad Advisory Committee.

The present report summarizes the 1974 operation. Items discussed include (1) schedule of operation, (2) attraction velocity, (3) disposition of catch, (4) a creel census conducted below Conowingo Dam, (5) statistics on the catch of the American shad, and (6) a comparison of data obtained in 1974 with that of 1972 and 1973.

METHODS

Schedule of Operation

The facility was operated from one-half hour before sunrise to 1100 hours (EST) from 18 April through 30 June, and from 1100 to 1900 hours (EST) from 28 May through 12 June. Operation was continued after 1100 hours on 25 April and on 25 and 27 May because shad were collected in morning lifts. The facility was not operated on 20 and 21 April due to a failure of the hopper hoist mechanism. Operation was reduced, due to mechanical failure of the lift, from 15 minutes to 10 hours per day on 14 days. In most cases repairs were made within one hour.

The length of fishing time per lift depended upon the relative abundance of fishes. It ranged from 1 to 60 minutes. One minute sets were used when large numbers of herring were present. Sixty minute sets were used when few fish were being taken.

Attraction Velocity

The standard attraction velocity used was 6.8 ft/sec. This was established by setting House Unit No. 1 at approximately 35% gate, House Unit No. 2 at 75% gate, and the weir gates at 6 feet below the tailrace. Velocity was reduced, on 3 May, at times of low tailrace, to 5.0 feet per second when pressure from the higher velocity interferred with operation of the crowder.

An experimental schedule of velocities was initiated on 31 May and continued through 30 June. On alternating days, Service Unit No. 2 was reduced to 25 or 40 percent gate to achieve attraction velocities of 6.2 and 4.6 feet per second, respectively. This was done during the first 3 hours of each operating day in an effort to determine the effectiveness of a reduced volume of flow in attracting shad.

Tests were also conducted to determine any differences in catch at each of two positions of the crowder gates. The intermediate gate position was used on one lift and the full-open position on the next, throughout the day. This procedure was carried out from 26 April through 30 June.

Operation of Conowingo Hydroelectric Station in the spring is, in part, regulated by the occurrence of anadromous fish runs. As part of an agreement with the State of Maryland, to prevent fish mortality in the tailrace due to oxygen deficiences, a generator was operated continuously between 29 April and 31 May (Euston, 1974). Complete shutdowns occurred after 31 May. The selection of which unit to operate was made by the biologist conducting a surveillance and depended upon the relative abundance and distribution of fishes (primarily blueback herring and alewife) in the tailrace. Main Generator No. 2 was operated to create suitable conditions per the above agreement and to enhance the attraction of shad along the west bank of the tailrace near the facility. Main Generator No. 2 was always one of the units on during regular operation of the Conowingo Hydroelectric Station until 11 June when it underwent repair.

Station engineers were requested not to operate Main Generator No. 1, whenever possible, because of potential negative effects of the turbulence produced by the Unit No. 1 discharge on the attraction flow of the facility. This request was followed and Main Generator No. 1 was always the last unit to be used during the times the facility was operating.

Disposition of Catch

All lifts were released into a 6' x 12' x 4' sorting tank. The catch was first examined for shad which were immediately transferred to a transport tank. Sex and spawning condition were noted. Shad were then transported above Conowingo Dam.

Other species were counted when all shad had been removed. Large catches were subsampled using the technique described by Robbins (1972). An estimate of the numbers of fishes in the tank was made from this subsample. All catches were subsampled or counted entirely, except those that were so large that mortalities due to an oxygen deficiency were possible. These were released back into the river immediately.

Two types of tanks were used to transport shad. A 460 gallon fiberglass tank was used through 30 April. It was then replaced by the 600 gallon plywood tank constructed by the Pennsylvania Fish Commission in 1972. This larger tank is equipped with air pumps to provide aeration for longer holding of shad. The smaller tank was used to hold shad that were collected while the transport truck was hauling shad caught in previous lifts.

Length, weight, sex and scale samples were taken from all of the anadromous species and the common resident species.

Creel Census

A creel census was conducted below Conowingo Dam to determine: (1) if the distribution of shad changes in the tailrace with the varying operation of Conowingo Hydroelectric Station and (2) if any relationship existed in the availability of shad to the anglers versus the success of collection of shad in the fish facility.

A census was made of the number and distribution of boat anglers and anglers fishing from the west shore. The catch of the shore anglers was counted daily once an hour from approximately 0400 to 1100 hours (EST) between 18 April and 30 June. Changes in the distribution of boats was determined by a count of the number in two sections of the tailrace which was divided into east and west sections by establishing an imaginary line from Main Generator No. 6 to the tip of Rowland's Island.

RESULTS

A total of 1,694,549 fish representing 10 families and 42 species was collected in 1974 (Table 1). The white perch (907,896), blueback herring (333,986), American eel (126,543), and channel catfish (101,573) were most common. A total of 127 adult and 1 juvenile American shad was taken.

The most unusual species collected was the menhadden (Brevortia tyrannus). This was the first time it had been collected in the facility.

The anadromous clupeids (alewife, blueback herring, hickory shad and American shad) made up 20% of the catch and individually accounted for a great deal of the weekly variation in catch composition (Table 1). The peak of the alewife spawning run was missed because of the facility starting operation on 18 April. Large numbers of alewives were observed in the tailrace in the two weeks prior to the first operation of the facility. The largest peak in the blueback herring run occurred in the week of 28 April (water temperature 57 to 62 F). Most of the hickory shad were taken in the same week. Large numbers of blueback herring were caught through 8 June at water temperatures up to 71 F. The American shad was first collected on 25 April at a water temperature of 56 F. The last shad was taken on 30 June at a water temperature of 74 F.

American Shad Catch

A total of 127 adult and one yearling American shad was collected between 24 April and 30 June. One hundred and twelve adults were transported above Conowingo Dam. Most shad quickly disappeared from view after release into Conowingo Pond. A few momentarily meandered near the surface before disappearing from view.

The sex ratio of 116 adults examined was 1:1.4. The spawning condition of 104 individuals was: 39.4% green, 54.8% ripe and 5.8% spent (Table 2).

Most of the shad (73.0%) were taken at an attraction velocity of 6.8 feet per second. The data, however, is not sufficient to suggest an optimum attraction velocity. Mode of operation of the Conowingo Hydroelectric Station and time of day may be more important factors in determining the catch. All of the recorded parameters, for each lift containing shad, are included in Table 3. The largest percentage (60.2%) were collected when none of the large units were operating (Table 4). A total of 58 (45.3%) was taken under the latter conditions and when none or only one of the small generators was operating. Four (3.1%) were taken when Unit No. 1 was generating.

Most shad (71.0%) were collected between 0500 and 1100 hours (EST) (Table 5). The remainder were taken throughout the afternoon. None were taken after 1900 hours.

The majority (82.1%) were taken at water temperatures of 70 and 71 F (Table 6). A total of 63 shad (49.2%) was collected at Conowingo during clear or partly sunny weather. The remainder was taken under overcast or foggy conditions (35.9%) and during light and heavy rain (14.8%).

More shad were taken at the intermediate gate position (60.2%) than at the full-open position (39.8%). This ratio may have been closer to 50:50 if it had been practical to open the gates to the full position during one minute lifts when blueback herring were present in large numbers. Twenty-five shad were taken under the latter conditions.

Creel Census

Results of the creel census indicate that very few shad were taken by anglers along the west shore of the tailrace. A total of 51 was taken from 18 April through 30 June. Anglers were most successful during the first week in May when 26 shad were taken (Table 7). Fishing effort for shad was also highest at this time (Table 8).

Angling effort from boats was greatest on the east side of the tailrace (below the large units) where the seasons count of anglers was 3.4 per hour compared with 1.3 per hour on the west side of the tailrace (Table 9). There were more boat anglers on the west side of the tailrace only when there were no large units operating. Under these conditions, 53.9% of the effort was on the west side. Anglers along the west shore caught 42.5% of their shad when three or more large units were operating and the remainder when no large units were operating (Table 10).

The results of the creel census are not directly comparable to those of the facility. Many people continued to fish through the month of June, but the effort expended to catch shad at this time was very low. Most people were fishing with bait by the first week in June. The angler catch, therefore, does not reflect the number of shad that might have been caught in June. The operation of the facility, on the other hand, was relatively constant from mid-April through June. The effect of this difference in effort is that a comparison of the creel census catch data with the catch data of the facility suggests an inverse relationship between the catch of anglers along the west shore and the numbers of shad collected in the facility with regard to time of year and water temperature (Tables 6, 7, 11 and 12). This may not be a realistic conclusion.

The time of day that shad are caught in the facility and by anglers along the west shore appears to be basically the same (Tables 5 and 13).

Summary of Operation - 1972 to 1974

Since 1972, 497 American shad have been taken in the Conowingo Dam Fish Collection Facility. The conditions under which shad were taken each year were quite similar. The majority of shad (77.5%) were caught from 0500 to 0900 hours (EST) (Table 5). The total catch between 1100 and 1900 hours was 17.0%. The percentage of shad caught during each one hour period was relatively constant for each of the three years.

Most shad (70.4%) collected by the facility were taken at water temperatures of 68 to 71 F (Table 6). Anglers caught most shad (93.7%) at water temperatures of 57 to 64 F (Table 12).

In 1973 and 1974, 66.0% of the shad were taken in the facility when no large units were operating (Table 4). For the same time period, anglers fishing from shore took 17.0% of their catch under similar conditions (Table 10). Most of the angler catch (52.3%) was taken when all units were operating.

Boat angler effort indicates a distinct preference for the east side of the tailrace, except when no large units are running. When the latter condition existed, 56.4% of the effort was on the west side of the tailrace (Table 9). When one or more large units were operating, 83.8% of the angler effort was on the east side of the tailrace.

The sex ratio of the shad taken in the facility in 1973 and 1974 was 43.2% males and 56.8% females (Table 2). Most (76.3%) were either green or ripe.

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Table 1. Numbers of fishes taken in the Conowingo Dam Fish Collection Facility, 18 April through 30 June 1974.

Dates	15-20 Apr	21-27 Apr	28 Apr-4 May	5-11 May	12-18 May	19-25 May
No. Lifts	15	72	74	75	66	80
Fishing Time (hr)	5.8	23.5	16.3	18.7	20.9	11.9
Water Temperature (F)	52-56	56-58	57-62	60-63	59-66	68-71
Anguillidae						
Anguilla rostrata	-	154	3137	6156	356	2815
Clupeidae						
Alosa aestivalis	31	26176	137171	30320	1526	60064
A. mediocris	-	3	176	-	-	-
A. pseudoharengus	788	7248	2616	126	86	-
A. sapidissima	-	9	2	-	-	18
Brevoortia tyrannus	-	-	-	-	-	-
Dorosoma cepedianum	12	1126	592	2785	6105	32451
Salmonidae						
Salmo gairdneri RBT	-	-	-	-	-	2
S. trutta BRT	1	13	14	8	8	68
Salvelinus fontinalis BT	-	-	-	-	-	4
Salmonid hybrid Splake	-	-	-	-	-	1
Esocidae						
Esox lucius NP	-	1	-	1	-	-
E. masquinongy Musky	-	6	-	1	-	-
E. niger chain	-	-	-	10	-	-

continued

Table 1. Continued.

Dates	26 May-1 Jun	2-8 Jun	9-15 Jun	16-22 Jun	23-30 Jun	Totals
No. Lifts	125	181	132	53	56	929
Fishing Time (hr)	38.7	45.8	39.1	30.1	38.3	289.1
Water Temperature (F)	70-71	69-70	70-73	74-76	74-77	
Anguillidae						
Anguilla rostrata	13049	13477	52795	32438	2166	126543
Clupeidae						
Alosa aestivalis	180	61208	13379	2470	1461	333986
A. mediocris	-	-	40	-	-	219
A. pseudoharengus	12	4630	1492	53	1	17052
A. sapidissima	55	28	8	5	2	127
Brevoortia tyrannus	-	50	62	-	1	113
Dorosoma cepedianum	30442	31090	15021	758	2109	122491
Salmonidae						
Salmo gairdneri	6	12	-	1	-	21
S. trutta	176	82	213	40	2	625
Salvelinus fontinalis	-	-	-	-	-	4
Salmonid hybrid	24	-	-	-	-	25
Esocidae						
Esox lucius	-	-	-	-	-	2
E. masquinongy	1	1	-	-	-	9
E. niger	-	-	-	-	-	10

continued

Table 1. Continued.

Dates	15-20 Apr	21-27 Apr	28 Apr-4 May	5-11 May	12-18 May	19-25 May
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Fishing Time (hr)	5.8	23.5	16.3	18.7	20.9	11.9
Water Temperature (F)	52-56	56-58	57-62	60-63	59-66	68-71
Cyprinidae						
Carassius auratus ~~Common~~ Goldfish	-	-	-	-	-	-
Cyprinus carpio Carp	-	8	316	339	1989	3328
Notemigonus crysoleucas G.S.	-	18	70	71	33	84
Notropis amoenus Comely Spotfin	-	16	1	-	-	2540
N. hudsonius	-	53	1267	224	-	92
N. spilopterus	-	8	6	-	1	16
Rhinichthys cataractae	-	1	-	-	-	-
Catostomidae						
Carpiodes cyprinus Quillback.	-	8	10	36	785	1978
Catostomus commersoni White Sucker	2	45	64	46	56	22
Erimyzon oblongus Creek Chubsucker	-	-	-	-	-	-
Moxostoma macrolepidotum Shorthead Redhorse		3	20	47	237	96
Ictaluridae						
Ictalurus catus White	1	-	-	10	46	1220
I. natalis Yellow	-	-	-	-	-	-
I. nebulosus Brown	-	2	6	93	69	988
I. punctatus Channel	71	600	359	1878	11134	17558
Percichthydae						
Morone americana White	-	12020	96797	135404	49871	105866
M. saxatilis Striped	-	2	5	5	-	10

continued

Table 1. Continued.

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Water Temperature (F)	70-71	69-70	70-73	74-76	74-77	
Cyprinidae						
Carassius auratus	-	-	1	-	1	2
Cyprinus carpio	9032	7825	11386	1565	978	36766
Notemigonus crysoleucas	27	67	77	56	13	516
Notropis amoenus	425	114	774	-	-	3870
N. hudsonius	50	-	350	295	-	2331
N. spilopterus	418	281	2281	161	413	3585
Rhinichthys cataractae	-	-	-	-	-	1
Catostomidae						
Carpiodes cyprinus	5799	2725	3226	229	383	15179
Catostomus commersoni	26	11	12	-	-	284
Erimyzon oblongus	1	-	-	-	-	1
Moxostoma macrolepidotum	30	1	-	-	-	434
Ictaluridae						
Ictalurus catus	75	340	508	25	199	2424
I. natalis	1	-	-	-	4	5
I. nebulosus	99	58	297	80	193	1885
I. punctatus	7158	13215	23475	6274	19851	101573
Percichthydae						
Morone americana	48696	304443	144015	8834	1950	907896
M. saxatilis	104	199	805	323	552	2005

continued

Table 1. Continued.

Dates	15-20 Apr	21-27 Apr	28 Apr-4 May	5-11 May	12-18 May	19-25 May
No. Lifts	15	72	74	75	66	80
Fishing Time (hr)	5.8	23.5	16.3	18.7	20.9	11.9
Water Temperature (F)	52-56	56-58	57-62	60-63	59-66	68-71
Centrarchidae						
Ambloplites rupestris Rock bass	-	1	3	-	6	-
Lepomis auritus RB	-	23	41	64	40	274
L. cyanellus Green	-	-	-	-	-	-
L. gibbosus P.S.	-	7	532	297	100	133
L. macrochirus BG.	-	17	100	193	19	54
L. Hybrid	-	-	-	-	-	5
Micropterus dolomieui SMB	-	4	21	3	3	-
M. salmoides LMB	-	4	1	-	12	4
Pomoxis annularis W crappie	-	10	213	326	111	262
P. nigromaculatus Black	-	1	5	-	5	-
Percidae						
Etheostoma olmstedi TESS	-	-	-	-	-	-
Perca flavescens Y.P.	-	7	43	75	12	54
Stizostedion vitreum walleye	9	62	48	31	99	163
Total	915	47656	243636	170132	72709	230170

continued

Table 1. Continued.

Dates	26 May-1 Jun	2-8 Jun	9-15 Jun	16-22 Jun	23-30 Jun	Totals
No. Lifts	125	181	132	53	56	929
Fishing Time (hr)	38.7	45.8	39.1	30.1	38.3	289.1
Water Temperature (F)	70-71	69-70	70-73	74-76	74-77	
Centrarchidae						
Ambloplites rupestris	8	13	-	10	11	52
Lepomis auritus	390	334	250	211	115	1742
L. cyanellus	-	2	2	-	2	6
L. gibbosus	330	448	697	360	271	3175
L. macrochirus	174	150	237	294	275	1513
L. Hybrid	-	1	-	-	-	6
Micropterus dolomieui	14	30	44	8	-	127
M. salmoides	1	1	-	2	-	25
Pomoxis annularis	340	520	2025	967	563	5337
P. nigromaculatus	1	1	16	8	5	42
Percidae						
Etheostoma olmstedi	-	4	-	-	-	4
Perca flavescens	41	147	285	46	21	731
Stizostedion vitreum	351	375	489	70	108	1805
Total	117536	441883	274262	55583	31650	1,694,549

Table 2. Sex ratio and spawning condition of American shad (Alosa sapidissima) collected in the Conowingo Dam Fish Collection Facility in 1973 and 1974.

Year	Male		Female				Undetermined	Total
	Ripe	Spent	Green	Ripe	Spent	Undetermined		
1973	34	1	22	1	12	0	5	75
%	45.3	1.3	29.3	1.3	16.0	-	6.7	
1974	48	0	41	9	6	12	12	128
%	37.5	-	32.0	7.0	4.7	9.4	9.4	
Total	82	1	63	10	18	12	17	203
%	40.4	0.5	31.0	4.9	8.9	5.9	8.4	

Total No. Males and Females	83	109
%	43.2	56.8

Table 3. Data describing conditions for each lift when American shad (Alosa sapidissima) were taken in the Conowingo Dam Fish Collection Facility, 18 April through 30 June 1974.

Date	25 Apr					27 Apr
Lift Number	3	5	6	8	9	5
PARAMETERS*						
Shad Taken	1	1	2	1	1	3
Total Fish	2193	4721	3103	3361	2981	718
Rel. Loc.	1	1	1	1	1	1
Lift Time	0540	0625	0645	0735	0755	0700
Min. Fished	5	5	5	5	5	30
Air Temp.	47	47	47	47	47	53
Water Temp.	56	56	56	56	56	58
Weather	1	1	1	1	1	1
At. Pressure	30.12	30.16	30.12	30.16	30.16	30.26
Small Gen. on	0	0	0	0	6	6
Large Gen. on	0	0	0	0	2	1
Unit 1	2	2	2	2	1	2
Unit 2	2	2	2	2	1	1
Spill gates open	0	0	0	0	0	0
River Flow	41.7	41.7	41.7	41.7	41.7	41.7
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5	99.9
Vel. Weir 1	6.8	6.8	6.8	6.8	6.8	99.9
Vel. Weir 2	6.8	6.8	6.8	6.8	6.8	99.9
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6	6	6	6	6	99.9
Weir 2	6	6	6	6	6	99.9
Tailrace Elev.	12.0	12.0	12.0	12.0	12.0	99.9
Hld. Chan. Elev.	12.9	12.9	12.9	12.9	12.9	99.9
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	2	2	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	2 May			19 May	21 May	22 May
Lift Number	6	8	9	9	8	3
PARAMETERS*						
Shad Taken	1	1	1	1	1	1
Total Fish	16501	7051	2301	1021	7001	7001
Rel. Loc.	1	1	1	1	1	1
Lift Time	0649	0801	0846	0915	0641	0508
Min. Fished	1	1	1	30	1	1
Air Temp.	48	48	49	65	54	57
Water Temp.	61	61	61	66	68	70
Weather	2	3	3	3	2	1
At. Pressure	30.18	30.20	30.22	30.15	30.25	30.00
Small Gen. on	2	4	4	4	1	1
Large Gen. on	0	1	1	2	0	0
Unit 1	2	2	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	26.7	26.7	26.7	49.8	41.7	37.9
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	1.5	99.9	1.5	1.5
Vel. Weir 1	6.8	6.8	6.8	99.9	6.8	6.8
Vel. Weir 2	6.8	6.8	6.8	99.9	6.8	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	6.0	99.9	6.0	6.0
Weir 2	6.0	6.0	6.0	99.9	6.0	6.0
Tailrace Elev.	14.8	17.1	18.5	99.9	13.9	13.8
Hld. Chan. Elev.	15.5	18.1	19.5	99.9	14.5	14.5
Crowder Position	2	2	2	1	1	1
Cr. Gate Position	2	2	2	2	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	22 May		25 May			
Lift Number	5	7	7	8	10	14
PARAMETERS*						
Shad Taken	1	1	1	3	2	2
Total Fish	7001	1961	2161	3043	5002	4002
Rel. Loc.	1	1	1	1	1+2	1
Lift Time	0551	0626	0655	0730	0850	1050
Min. Fished	1	1	10	20	30	25
Air Temp.	60	62	59	59	65	70
Water Temp.	70	70	70	70	70	70
Weather	1	1	3	3	1	2
At. Pressure	30.00	30.00	29.85	29.86	29.85	29.86
Small Gen. on	1	1	1	3	3	5
Large Gen. on	0	0	0	0	0	3
Unit 1	2	2	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	37.9	37.9	29.5	29.5	29.5	29.5
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	1.5	99.9	1.5	1.5
Vel. Weir 1	6.8	6.8	6.8	99.9	6.8	6.8
Vel. Weir 2	6.8	6.8	6.8	99.9	6.8	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	6.0	99.9	6.0	6.0
Weir 2	6.0	6.0	6.0	99.9	6.0	6.0
Tailrace Elev.	13.8	13.8	13.9	99.9	15.5	18.8
Hld. Chan. Elev.	14.5	14.5	14.6	99.9	16.4	19.6
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	1	1	2	1	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	25 May				26 May	
Lift Number	15	16	18	19	6	7
PARAMETERS*						
Shad Taken	2	1	1	1	1	1
Total Fish	1362	1326	2002	3001	1461	2401
Rel. Loc.	1	1	1	2	1	1
Lift Time	1120	1150	1245	1315	0710	0745
Min. Fished	15	15	15	15	20	20
Air Temp.	70	72	73	73	51	57
Water Temp.	70	70	70	70	70	70
Weather	1	1	1	1	1	1
At. Pressure	29.84	29.84	29.84	29.84	29.91	29.91
Small Gen. on	4	4	4	4	4	4
Large Gen. on	1	1	1	1	0	0
Unit 1	2	2	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	29.5	29.5	29.5	29.5	27.8	27.8
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5	1.5
Vel. Weir 1	6.8	6.8	6.8	6.8	6.8	6.8
Vel. Weir 2	6.8	6.8	6.8	6.8	6.8	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	6.0	6.0	6.0	6.0
Weir 2	6.0	6.0	6.0	6.0	6.0	6.0
Tailrace Elev.	17.5	17.5	17.5	17.5	16.2	16.2
Hld. Chan. Elev.	18.4	18.4	18.3	18.3	16.9	16.9
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	1	1	2	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	26 May		27 May			
Lift Number	9	12	4	5	6	11
PARAMETERS*						
Shad Taken	1	1	3	2	2	3
Total Fish	1101	2501	6943	2982	2592	1043
Rel. Loc.	1	1	1+2	1+2	2	1
Lift Time	0855	1040	0600	0630	0700	1015
Min. Fished	20	20	30	15	15	30
Air Temp.	62	66	55	56	56	65
Water Temp.	70	70	70	70	70	70
Weather	1	1	3	3	3	3
At. Pressure	29.91	29.91	29.85	29.85	29.85	29.86
Small Gen. on	4	4	1	1	1	4
Large Gen. on	0	0	0	0	0	1
Unit 1	2	2	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	27.8	27.8	27.3	27.3	27.3	27.3
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5	1.5
Vel. Weir 1	6.8	6.8	6.8	6.8	6.8	6.8
Vel. Weir 2	6.8	6.8	6.8	6.8	6.8	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	6.0	6.0	6.0	6.0
Weir 2	6.0	6.0	6.0	6.0	6.0	6.0
Tailrace Elev.	16.2	16.2	13.9	13.9	13.9	17.5
Hld. Chan. Elev.	16.9	16.9	14.8	14.8	14.8	18.4
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	1	2	2	1	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	27 May	28 May				
Lift Number	12	6	8	9	10	11
PARAMETERS*						
Shad Taken	1	1	2	3	1	1
Total Fish	1801	337	965	554	376	201
Rel. Loc.	2	1	2	1+2	1	1
Lift Time	1100	0655	0825	0855	0925	0955
Min. Fished	30	30	30	15	15	15
Air Temp.	65	58	62	64	64	65
Water Temp.	70	70	70	70	70	70
Weather	3	1	1	1	1	1
At. Pressure	29.86	30.01	30.04	30.04	30.05	30.05
Small Gen. on	4	3	5	6	6	6
Large Gen. on	1	0	2	4	4	4
Unit 1	2	2	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	27.3	25.7	25.7	25.7	25.7	25.7
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	99.9	99.9	1.5	1.5
Vel. Weir 1	6.8	6.8	99.9	99.9	6.8	6.8
Vel. Weir 2	6.8	6.8	99.9	99.9	6.8	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	99.9	99.9	6.0	6.0
Weir 2	6.0	6.0	99.9	99.9	6.0	6.0
Tailrace Elev.	17.5	15.2	99.9	99.9	19.8	19.8
Hld. Chan. Elev.	18.4	16.1	99.9	99.9	20.7	20.7
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	2	1	2	2

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	28 May				29 May	
Lift Number	15	17	19	21	5	6
PARAMETERS*						
Shad Taken	1	1	1	2	2	2
Total Fish	297	939	285	742	554	1132
Rel. Loc.	1	1	1	2	2	2
Lift Time	1140	1250	1350	1450	0640	0725
Min. Fished	10	20	15	20	30	30
Air Temp.	68	70	75	74	63	63
Water Temp.	70	70	70	70	70	70
Weather	1	1	1	1	4	3
At. Pressure	30.04	30.04	30.02	30.02	29.82	29.82
Small Gen. on	5	7	5	5	1	4
Large Gen. on	4	4	4	4	0	0
Unit 1	2	1	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	25.7	25.7	25.7	25.7	23.1	23.1
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	99.9	1.5	1.5	1.5	99.9
Vel. Weir 1	6.8	99.9	6.8	6.8	6.8	99.9
Vel. Weir 2	6.8	99.9	6.8	6.8	6.8	99.9
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	99.9	6.0	6.0	6.0	99.9
Weir 2	6.0	99.9	6.0	6.0	6.0	99.9
Tailrace Elev.	19.8	99.9	19.9	19.9	13.9	99.9
Hld. Chan. Elev.	20.5	99.9	20.5	20.5	14.5	99.9
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	1	1	2	1	2

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	29 May					30 May
Lift Number	12	17	18	21	22	5
PARAMETERS*						
Shad Taken	1	2	1	1	1	1
Total Fish	177	200	138	295	898	569
Rel. Loc.	1	1	1	1	1	1
Lift Time	1125	1355	1430	1635	1720	0647
Min. Fished	15	20	20	20	30	30
Air Temp.	66	74	73	74	72	65
Water Temp.	70	70	70	70	70	71
Weather	3	3	3	3	3	3
At. Pressure	29.72	29.67	29.66	29.60	29.60	29.64
Small Gen. on	4	4	4	4	4	1
Large Gen. on	2	4	2	0	0	0
Unit 1	2	2	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	23.1	23.1	23.1	23.1	23.1	22.2
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	99.9	1.5	1.5	1.5
Vel. Weir 1	6.8	6.8	99.9	6.8	6.8	6.8
Vel. Weir 2	6.8	6.8	99.9	6.8	6.8	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	99.9	6.0	6.0	6.0
Weir 2	6.0	6.0	99.9	6.0	6.0	6.0
Tailrace Elev.	18.0	19.7	99.9	16.5	16.5	13.9
Hld. Chan. Elev.	18.8	20.2	99.9	17.3	17.3	14.6
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	1	1	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	30 May					
Lift Number	11	13	15	17	20	21
PARAMETERS*						
Shad Taken	6	2	1	1	1	2
Total Fish	207	220	336	516	477	485
Rel. Loc.	1	1	1	1	1	1
Lift Time	1130	1230	1400	1530	1745	1830
Min. Fished	30	15	30	30	30	30
Air Temp.	74	74	74	76	70	74
Water Temp.	71	71	71	71	71	71
Weather	3	3	3	1	1	1
At. Pressure	29.69	29.69	29.69	29.69	29.74	29.74
Small Gen. on	4	4	4	4	3	3
Large Gen. on	2	4	4	1	0	0
Unit 1	2	2	2	2	2	2
Unit 2	1	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	22.2	22.2	22.2	22.2	22.2	22.2
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5	1.5
Vel. Weir 1	6.8	6.8	6.8	6.8	6.8	6.8
Vel. Weir 2	6.8	6.8	6.8	6.8	6.8	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	6.0	6.0	6.0	6.0
Weir 2	6.0	6.0	6.0	6.0	6.0	6.0
Tailrace Elev.	18.5	19.8	19.8	17.4	16.2	16.2
Hld. Chan. Elev.	19.1	20.5	20.5	17.9	16.9	16.9
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	1	1	1	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	31 May		2 June			
Lift Number	13	18	2	4	9	10
PARAMETERS*						
Shad Taken	2	1	1	3	4	1
Total Fish	259	536	9201	5263	9304	6721
Rel. Loc.	1	1	1	1	1	1
Lift Time	1300	1630	0505	0529	0711	0816
Min. Fished	30	30	2	1	1	1
Air Temp.	67	67	68	68	57	57
Water Temp.	70	70	70	70	70	70
Weather	3	4	4	5	4	4
At. Pressure	29.96	29.93	29.97	29.97	30.00	30.00
Small Gen. on	4	5	0	0	0	0
Large Gen. on	2	2	0	0	0	0
Unit 1	2	2	2	2	2	2
Unit 2	1	1	2	2	2	2
Spill gates open	0	0	0	0	0	0
River Flow	21.7	21.7	23.6	23.6	23.6	23.6
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	25	25	25	40
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5	1.5
Vel. Weir 1	6.8	6.8	6.2	6.2	6.2	4.6
Vel. Weir 2	6.8	6.8	6.0	6.0	6.0	4.6
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	6.0	3.0	3.0	3.0	5.0
Weir 2	6.0	6.0	3.0	3.0	3.0	5.0
Tailrace Elev.	18.0	18.5	11.8	11.8	11.8	12.0
Hld. Chan. Elev.	18.5	19.3	12.8	12.8	12.8	12.5
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	1	2	1	2	2	2

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	2 June					3 June
Lift Number	11	12	13	21	25	6
PARAMETERS*						
Shad Taken	2	2	2	1	1	1
Total Fish	6602	8502	8002	882	3126	7061
Rel. Loc.	1	1+2	1	2	1	1
Lift Time	0831	0901	0916	1240	1435	0646
Min. Fished	1	1	1	15	5	1
Air Temp.	58	58	58	60	60	61
Water Temp.	70	70	70	70	70	69
Weather	4	4	4	4	3	2
At. Pressure	30.00	30.00	30.00	30.02	30.00	30.10
Small Gen. on	0	0	0	3	0	0
Large Gen. on	0	0	0	0	0	0
Unit 1	2	2	2	2	2	2
Unit 2	2	2	2	2	2	2
Spill gates open	0	0	0	0	0	0
River Flow	23.6	23.6	23.6	23.6	23.6	22.8
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	40	40	40	75	25	40
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	-	1.5
Vel. Weir 1	4.6	4.6	4.6	6.8	-	4.6
Vel. Weir 2	4.6	4.6	4.6	6.8	-	4.6
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	5.0	5.0	5.0	6.0	4.9	5.0
Weir 2	5.0	5.0	5.0	6.0	4.9	5.0
Tailrace Elev.	12.0	12.0	12.0	15.9	13.9	12.0
Hld. Chan. Elev.	12.5	12.5	12.5	16.5	14.4	12.5
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	2	2	2	2

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	3 June	5 June				
Lift Number	14	3	4	6	7	21
PARAMETERS*						
Shad Taken	1	1	1	1	1	1
Total Fish	751	1231	8101	8101	7101	95
Rel. Loc.	1	1	1	1	1	1
Lift Time	1115	0506	0539	0611	0626	1520
Min. Fished	15	1	1	1	1	30
Air Temp.	71	57	59	60	60	80
Water Temp.	69	70	70	70	70	70
Weather	2	1	6	6	6	1
At. Pressure	30.11	30.25	30.25	30.25	30.25	30.19
Small Gen. on	4	0	0	0	0	4
Large Gen. on	2	0	0	0	0	4
Unit 1	1	2	2	2	2	2
Unit 2	1	2	2	2	2	1
Spill gates open	0	0	0	0	0	0
River Flow	22.8	20.9	20.9	20.9	20.9	20.9
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	40	40	40	40	75
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5	1.5
Vel. Weir 1	6.8	4.6	4.6	4.6	4.6	6.8
Vel. Weir 2	6.8	4.6	4.6	4.6	4.6	6.8
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	6.0	5.0	5.0	5.0	5.0	6.0
Weir 2	6.0	5.0	5.0	5.0	5.0	6.0
Tailrace Elev.	18.9	12.0	12.0	12.0	12.0	19.4
Hld. Chan. Elev.	19.8	12.5	12.5	12.5	12.5	20.3
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	1	2	2	2	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	6 June		8 June		9 June	
Lift Number	6	12	7	8	10	11
PARAMETERS*						
Shad Taken	1	1	1	1	1	2
Total Fish	6721	689	2661	4681	1941	1390
Rel. Loc.	1	1	1	1	1	1
Lift Time	0617	1010	0705	0750	0805	0850
Min. Fished	2	30	30	30	15	30
Air Temp.	57	72	65	65	68	69
Water Temp.	70	70	70	70	70	70
Weather	6	2	3	3	2	1
At. Pressure	30.15	30.17	30.10	30.10	30.05	30.03
Small Gen. on	0	4	0	0	0	0
Large Gen. on	0	2	0	0	0	0
Unit 1	2	2	2	2	2	2
Unit 2	2	1	2	2	2	2
Spill gates open	0	0	0	0	0	0
River Flow	19.4	19.4	16.7	16.7	15.8	15.8
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	25	75	25	40	40	40
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5	1.5
Vel. Weir 1	6.2	6.8	6.2	4.6	4.6	4.6
Vel. Weir 2	6.0	6.8	6.0	4.6	4.6	4.6
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	3.0	6.0	3.0	5.0	5.0	5.0
Weir 2	3.0	6.0	3.0	5.0	5.0	5.0
Tailrace Elev.	12.0	17.9	12.0	12.0	12.0	12.0
Hld. Chan. Elev.	12.9	18.7	12.9	12.5	12.5	12.5
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	2	1	2	1

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	9 June			10 June		17 June
Lift Number	17	18	30	3	19	4
PARAMETERS*						
Shad Taken	1	1	1	1	1	1
Total Fish	2031	10531	769	1841	3606	1101
Rel. Loc.	2	2	1	1	2	1
Lift Time	1200	1225	1750	0510	1700	0630
Min. Fished	10	10	20	5	30	45
Air Temp.	80	80	81	69	82	63
Water Temp.	70	70	70	71	71	74
Weather	1	1	1	6	1	2
At. Pressure	29.93	29.93	29.81	29.79	29.62	29.70
Small Gen. on	0	0	0	0	4	0
Large Gen. on	0	0	0	0	1	0
Unit 1	2	2	2	2	1	2
Unit 2	2	2	2	2	1	2
Spill gates open	0	0	0	0	0	0
River Flow	15.8	15.8	15.8	11.4	11.4	14.8
% Gate S.U. 1	35	35	35	35	50	35
% Gate S.U. 2	40	40	40	25	100	25
Vel. Hld. Chan.	1.5	1.5	-	-	-	1.5
Vel. Weir 1	4.6	4.6	-	-	-	6.2
Vel. Weir 2	4.6	4.6	-	-	-	6.0
Weir Gates open	3	3	3	3	3	3
Ft. Below TR						
Weir 1	5.0	5.0	5.7	5.0	7.0	3.0
Weir 2	5.0	5.0	5.7	5.0	7.0	3.0
Tailrace Elev.	12.0	12.0	12.7	12.0	17.5	11.8
Hld. Chan. Elev.	12.5	12.5	-	-	18.2	12.7
Crowder Position	1	1	2	1	1	1
Cr. Gate Position	1	1	1	1	1	2

continued

* Explanation of abbreviations and code numbers given on page 33.

Table 3. Continued.

Date	20 June		24 June	30 June
Lift Number	3	4	5	6
PARAMETERS*				
Shad Taken	1	3	1	1
Total Fish	257	679	324	309
Rel. Loc.	1	1	1	1
Lift Time	0530	0645	0805	0950
Min. Fished	30	60	60	60
Air Temp.	72	74	65	76
Water Temp.	76	76	77	74
Weather	2	2	2	2
At. Pressure	29.90	29.91	29.73	30.02
Small Gen. on	0	0	0	0
Large Gen. on	0	0	0	0
Unit 1	2	2	2	2
Unit 2	2	2	2	2
Spill gates open	0	0	0	0
River Flow	22.8	22.8	19.3	23.2
% Gate S.U. 1	35	35	35	35
% Gate S.U. 2	40	40	40	40
Vel. Hld. Chan.	1.5	1.5	1.5	1.5
Vel. Weir 1	4.6	4.6	4.6	4.6
Vel. Weir 2	4.6	4.6	4.6	4.6
Weir Gates open	3	3	3	3
Ft. Below TR				
Weir 1	5.0	5.0	5.1	5.0
Weir 2	5.0	5.0	5.1	5.0
Tailrace Elev.	11.8	11.8	12.1	11.8
Hld. Chan. Elev.	12.3	12.3	12.6	12.3
Crowder Position	1	1	1	1
Cr. Gate Position	1	2	2	1

* Explanation of abbreviations and code numbers given on page 33.

PARAMETER	ABBREVIATION	CODE
Date	Date	-
Lift Number	Lift Number	-
Number of shad in lift	Shad Taken	-
Total number of fish in lift	Total Fish	-
Location shad were released	Rel. Loc.	1. Above dam 2. Returned to tailrace
Time of lift	Lift Time	EST
Fishing Time (minutes)	Min. Fished	-
Air Temperature	Air Temp.	^{o}F
Water Temperature	Water Temp.	^{o}F
Weather	Weather	1. Clear, 2. Partly cloudy, 3. Overcast 4. Light Rain, 5. Heavy Rain, 6. Fog
Barometric pressure	At. Pressure	inches
Number of small generators operating	Small Gen. on	9. Varying
Number of large generators operating	Large Gen. on	9. Varying
Generating status of Unit 1	Unit 1	1. On, 2. Off
Generating status of Unit 2	Unit 2	1. On, 2. Off
Number of spill gates open	Spill gates open	-
Natural river flow	River Flow	cfs x 1000
Gate opening (%) of station service Unit 1	% Gate S.U. 1	-
Gate opening (%) of station service Unit 2	% Gate S.U. 2	-
Water Velocity in holding Channel (ft/sec)	Vel. Hld. Chan.	999. Varying
Attraction velocity at Entrance #1 (ft/sec)	Vel. Weir 1	999. Varying
Attraction velocity at Entrance #2 (ft/sec)	Vel. Weir 2	999. Varying
Number of weir gates open	Weir gates open	1. #1, 2. #2, 3. Both
Setting of each weir gate	Ft. Below TR	-
Setting of Weir #1	Weir 1	999. Varying
Setting of Weir #2	Weir 2	999. Varying
Tailrace Elevation	Tailrace Elev.	999. Varying
Holding Channel Elevation	Hld. Chan. Elev.	999. Varying
Crowder Fishing Position	Crowder Position	1. Full, 2. Reduced
Crowder Gate Position	Cr. Gate Position	1. Full Open, 2. Intermediate Open

Table 4. Number of American shad (Alosa sapidissima) taken in the Conowingo Dam Fish Collection Facility in 1973 and 1974 under various conditions of generation of the Conowingo Hydroelectric Station.

No. Units Operating		Status of	Status of	No. of Shad Caught			% of Catch		
Small	Large	Unit No. 1	Unit No. 2	1973	1974	Total	1973	1974	Total
0	0	OFF	OFF	10	43	53	13.3	33.6	26.1
1	0	OFF	ON	3	15	18	4.0	11.7	8.9
1	0	OFF	OFF	37	0	37	49.3	-	18.2
1	0	ON	OFF	1	0	1	1.3	-	0.5
2	0	OFF	ON	0	1	1	-	0.8	0.5
3	0	OFF	ON	5	10	15	6.7	7.8	7.4
3	0	OFF	OFF	1	0	1	1.3	-	0.5
4	0	OFF	ON	0	8	8	-	6.3	3.9
4	1	OFF	ON	0	12	12	-	9.4	5.9
4	1	ON	ON	0	1	1	-	0.8	0.5
4	2	OFF	OFF	1	0	1	1.3	-	0.5
4	2	OFF	ON	0	12	12	-	9.4	5.9
4	2	ON	ON	0	1	1	-	0.8	0.5
4	3	OFF	ON	2	0	2	2.7	-	1.0
4	4	OFF	ON	0	6	6	-	4.7	3.0
4	4	ON	ON	2	0	2	2.7	-	1.0
5	2	OFF	ON	0	3	3	-	2.3	1.5
5	3	OFF	ON	1	2	3	1.3	1.6	1.5
5	4	OFF	ON	1	4	5	1.3	3.1	2.5
6	1	OFF	ON	0	3	3	-	2.3	1.5
6	2	ON	ON	0	1	1	-	0.8	0.5
6	4	OFF	ON	0	5	5	-	3.9	2.5
7	4	ON	ON	8	1	9	10.7	0.8	4.4
Changing			Changing	3	0	3	4.0	-	1.5
Totals				75	128	203			

Table 5. Comparison of the percentage of American shad (Alosa sapidissima) taken in the Conowingo Dam Fish Collection Facility with time of day, 1972-1974.

Time of Day	1972		1973		1974		Total	
	No.	%	No.	%	No.	%	No.	%
0400-0459	0	-	6	8.0	0	-	6	1.2
0500-0559	10	3.4	25	33.3	11	8.6	46	9.3
0600-0659	113	38.6	22	29.3	24	18.8	159	32.1
0700-0759	66	22.6	6	8.0	20	15.6	92	18.5
0800-0859	64	21.8	2	2.7	17	13.3	83	16.7
0900-0959	5	1.7	1	1.3	8	6.3	14	2.8
1000-1059	2	0.7	2	2.7	7	5.5	11	2.2
1100-1159	1	0.3	2	2.7	13	10.2	16	3.2
1200-1259	3	1.0	2	2.7	7	5.5	12	2.4
1300-1359	7	2.4	1	1.3	6	4.7	14	2.8
1400-1459	4	1.4	0	-	5	3.9	9	1.8
1500-1559	0	-	2	2.7	2	1.6	4	0.8
1600-1659	3	1.0	2	2.7	2	1.6	7	1.4
1700-1759	9	3.1	2	2.7	4	3.1	15	3.0
1800-1859	6	2.0	0	-	2	1.6	8	1.6
Totals	293		75		128		496	

Table 6. Comparison of the percentage of American shad (Alosa sapidissima) taken in the Conowingo Dam Fish Collection Facility with water temperature, 1972-1974.

Temperature	1972		1973		1974		Total	
	No.	%	No.	%	No.	%	No.	%
56	0	-	0	-	6	4.7	6	1.2
58	0	-	2	2.7	3	2.3	5	1.0
59	2	0.7	0	-	0	-	2	0.4
60	2	0.7	1	1.3	0	-	3	0.6
61	0	-	0	-	3	2.3	3	0.6
62	2	0.7	3	2.3	0	-	5	1.0
63	0	-	1	2.3	0	-	1	0.2
64	1	0.3	3	4.0	0	-	4	0.8
65	0	-	1	1.3	0	-	1	0.2
66	0	-	0	-	1	0.8	1	0.2
67	4	1.4	4	4.3	0	-	8	1.6
68	17	5.8	0	-	1	0.8	18	3.6
69	24	8.2	10	13.3	2	1.6	36	7.3
70	116	39.6	17	22.7	88	68.8	221	44.6
71	57	19.5	0	-	17	13.3	74	14.9
72	3	1.0	0	-	0	-	3	0.6
73	0	-	5	6.7	0	-	5	1.0
74	65	27.2	1	1.3	2	1.6	68	13.7
75	0	-	22	29.3	0	-	22	4.4
76	0	-	0	-	4	3.1	4	0.8
77	0	-	1	1.3	1	0.8	2	0.4
78	0	-	0	-	0	-	0	-
79	0	-	4	5.3	0	-	4	0.8
Totals	293		75		128		496	

Table 7. Time of day American shad (Alosa sapidissima) were taken by anglers fishing from shore just downstream from the Conowingo Dam Fish Collection Facility, 18 April through 30 June 1974.

Date	Apr 27	Apr 28	Apr 29	Apr 30	May 2	May 3	May 4	May 5	May 6	May 8
Water Temp. (F)	58	57	58	59	61	60	62	62	62	61
Sunrise (EST)	0506	0505	0504	0502	0500	0459	0457	0456	0455	0453
Time (EST										
0500-0559	-	-	-	-	-	-	-	-	-	-
0600-0659	-	-	-	-	-	-	4	1	3	-
0700-0759	-	1	2	-	-	-	-	2	-	-
0800-0859	-	-	-	-	-	-	-	-	-	-
0900-0959	1	-	-	-	5	-	1	1	-	-
1000-1059	-	-	-	3	2	-	-	-	1	3
1100-1159	-	-	-	-	1	1	-	1	-	-
Totals	1	1	2	3	8	1	5	5	4	3

continued

Table 7. Continued.

Date	May 11	May 15	May 21	May 22	May 25	May 27	May 29	Jun 4	Total	%
Water Temp. (F)	60	63	68	70	70	70	70	69		
Sunrise (EST)	0450	0446	0440	0440	0437	0436	0435	0432		
Time (EST)										
0500-0559	-	-	-	-	2	-	-	-	2	3.9
0600-0659	-	-	-	-	2	-	-	-	10	19.6
0700-0759	2	-	-	-	2	1	2	-	12	23.5
0800-0859	-	3	1	-	-	-	-	-	4	7.8
0900-0959	-	-	-	-	-	-	-	1	9	17.6
1000-1059	1	-	-	1	-	-	-	-	11	21.6
1100-1159	-	-	-	-	-	-	-	-	3	5.9
Totals	3	3	1	1	6	1	2	1	51	

Table 8. Count of effort for anglers fishing from shore and by boat in the Conowingo Dam tailrace, 18 April through 30 June 1974.

Shore Angler Effort(Hours)				Boat Angler Effort(Hours)			
				East Side		West Side	
Date	Total	Mean	No. Shad Caught	Total	Mean	Total	Mean
18 Apr	46	8	0	0	0	0	0
19 Apr	88	15	0	0	0	0	0
20 Apr	35	18	0	0	0	0	0
22 Apr	90	13	0	0	0	0	0
23 Apr	83	12	0	1	0	0	0
24 Apr	113	16	0	0	0	0	0
25 Apr	133	10	0	0	0	0	0
26 Apr	159	20	0	6	1	0	0
27 Apr	281	40	1	4	1	8	1
28 Apr	281	47	1	51	9	15	3
29 Apr	195	28	2	2	0	0	0
30 Apr	130	22	3	13	2	6	1
1 May	157	26	0	5	1	0	0
2 May	267	33	8	46	6	2	0
3 May	154	22	1	6	1	6	1
4 May	320	53	5	94	16	10	2
5 May	303	43	5	60	9	79	11
6 May	218	31	4	34	5	2	0
7 May	99	20	0	22	4	3	1
8 May	173	25	3	52	7	12	2
9 May	113	19	0	14	2	0	0
10 May	79	13	0	51	9	17	3
11 May	244	41	3	70	12	68	11
12 May	147	21	0	25	4	57	8
13 May	64	11	0	29	5	1	0
14 May	64	9	0	34	5	0	0
15 May	105	18	3	38	6	0	0
16 May	67	10	0	15	2	0	0
17 May	51	9	0	22	4	2	0
18 May	200	29	0	47	7	7	1
19 May	240	34	0	123	18	12	2
20 May	63	9	0	26	4	2	0
21 May	46	8	1	35	6	2	0
22 May	85	12	1	27	4	2	0
23 May	66	9	0	8	1	6	1
24 May	94	12	0	69	9	9	1
25 May	259	26	6	81	8	47	5
26 May	267	38	0	56	15	28	4
27 May	236	30	1	70	9	36	5
28 May	67	8	0	52	7	0	0
29 May	31	4	2	45	6	1	0
30 May	35	5	0	19	3	15	2
31 May	24	3	0	22	3	1	0

continued

Table 8. Continued.

Date	Shore Angler Effort(Hours) Total	Mean	No. Shad Caught	Boat Angler Effort(Hours) East Side Total	Mean	West Side Total	Mean
1 Jun	167	19	0	43	5	6	1
2 Jun	80	13	0	12	2	2	0
3 Jun	40	6	0	0	0	26	4
4 Jun	60	10	1	4	1	0	0
5 Jun	28	4	0	1	0	2	0
6 Jun	17	2	0	4	1	0	0
7 Jun	31	4	0	0	0	2	0
8 Jun	138	23	0	4	1	8	1
9 Jun	158	26	0	0	5	28	5
10 Jun	14	2	0	0	0	0	0
11 Jun	22	3	0	0	0	0	0
12 Jun	19	3	0	8	1	8	1
13 Jun	28	4	0	4	0	0	0
14 Jun	45	6	0	0	0	0	0
15 Jun	121	17	0	20	3	19	3
16 Jun	138	20	0	15	3	22	3
17 Jun	17	2	0	4	0	0	0
18 Jun	28	4	0	8	0	0	0
19 Jun	11	2	0	8	0	0	0
20 Jun	16	3	0	12	1	6	1
21 Jun	44	6	0	13	0	0	0
22 Jun	92	15	0	16	0	0	0
23 Jun	82	12	0	0	4	30	4
24 Jun	3	1	0	0	0	0	0
25 Jun	23	3	0	6	0	0	0
26 Jun	11	2	0	20	0	0	0
27 Jun	17	2	0	11	0	3	0
28 Jun	14	2	0	2	0	0	0
29 Jun	45	6	0	4	1	5	1
30 Jun	196	33	0	0	6	19	6
Total	7675		51	1591		642	
Average Per Day	105.1	15.5	0.7	21.8	1.3	8.8	1.3

Table 9. The distribution of boats in the tailrace of Conowingo Dam, under various conditions of generation of Conowingo Hydroelectric Station, 1973 and 1974.

No. Units Operating		No. Boat Hrs East Side			No. Boat Hrs West Side			% East Side			% West Side		
Small	Large	1973	1974	Total	1973	1974	Total	1973	1974	Total	1973	1974	Total
0	0	0	26	26	0	37	37	-	41.3	41.3	-	58.7	58.7
1	0	21	29	50	15	64	79	58.3	31.2	38.8	41.7	68.8	61.2
2	0	6	7	13	16	8	24	27.3	46.7	35.1	72.7	53.3	64.9
3	0	6	24	30	14	24	38	30.0	50.0	44.1	70.0	50.0	55.9
4	0	22	75	97	32	63	95	40.7	54.3	50.5	59.3	45.7	49.5
5	0	0	0	0	6	0	6	-	-	-	100.0	-	100.0
0	1	3	0	3	0	0	0	100.0	-	100.0	-	-	-
3	1	3	0	3	2	0	2	60.0	-	60.0	40.0	-	40.0
4	1	39	97	136	38	23	61	50.6	80.8	69.0	49.4	19.2	31.0
5	1	0	2	2	0	0	0	-	100.0	100.0	-	-	-
3	2	1	25	26	1	6	7	50.0	80.6	78.8	50.0	19.4	21.2
4	2	35	59	94	33	9	42	51.5	86.8	69.1	48.5	13.2	30.9
5	2	4	5	9	1	0	1	80.0	100.0	90.0	20.0	-	10.0
6	2	2	3	5	0	0	0	100.0	100.0	100.0	-	-	-
3	3	2	0	2	0	0	0	100.0	-	100.0	-	-	-
4	3	31	70	101	8	18	26	79.5	79.5	79.5	20.5	21.5	20.5
5	3	30	25	55	4	4	8	88.2	86.2	87.3	11.8	13.8	12.7
6	3	1	0	1	0	0	0	100.0	-	100.0	-	-	-
7	3	7	0	7	1	0	1	87.5	-	87.5	12.5	-	12.5
3	4	9	0	9	4	0	4	69.2	-	69.2	30.8	-	30.8
4	4	38	34	72	5	6	11	88.4	85.0	86.7	11.6	15.0	13.3
5	4	25	55	80	4	2	6	86.2	96.5	93.0	13.8	3.5	7.0
6	4	22	8	30	1	2	3	95.7	80.0	90.9	4.3	20.0	9.1
7	4	804	219	1023	129	43	172	86.2	83.6	85.6	13.8	16.4	14.4
Changing		40	0	40	3	0	3	93.0	-	93.0	7.0	-	7.0
Total		1151	763	1914	317	290	607	78.4	72.5	75.9	21.6	27.5	24.1

Table 10. Status of generation of Conowingo Hydroelectric Station in relation to shore angler catch of American shad (Alosa sapidissima) for 1973 and 1974.

No. Units Operating		Status of	Status of	No. of Shad Caught			% of Catch		
Small	Large	Unit No. 1	Unit No. 2	1973	1974	Total	1973	1974	Total
1	0	OFF	ON	10	14	24	7.0	27.5	12.4
2	0	OFF	ON	0	2	2	-	3.9	1.0
3	0	OFF	ON	0	2	2	-	3.9	1.0
4	0	OFF	ON	0	5	5	-	9.8	2.6
4	1	OFF	ON	1	0	1	0.7	-	0.5
4	2	OFF	ON	2	0	2	1.4	-	1.0
3	3	ON	ON	1	0	1	0.7	-	0.5
4	3	OFF	ON	1	1	2	0.7	2.0	1.0
4	4	OFF	ON	0	9	9	-	17.6	4.7
4	4	ON	ON	1	0	1	0.7	-	0.5
5	4	OFF	ON	1	6	7	0.7	11.8	3.6
5	4	ON	ON	1	0	1	0.7	-	0.5
6	4	OFF	ON	1	3	4	0.7	5.9	2.1
7	3	ON	ON	2	0	2	1.4	-	1.0
7	4	ON	ON	92	9	101	64.8	17.6	52.3
Changing		Changing		5	0	5	3.5	-	2.6
Undetermined				24	0	24	16.9	-	12.4
Totals				142	51	193			

Table 11. Time of day American shad (Alosa sapidissima) were taken in the Conowingo Dam Fish Collection Facility, 18 April through 30 June 1974.

Date	Apr 25	Apr 27	May 2	May 19	May 21	May 22	May 25	May 26	May 27	May 28	May 29	May 30	May 31
Water Temp.(F)	56	58	61	66	68	70	70	70	70	70	70	71	70
Sunrise(EST)	0509	0506	0500	0442	0440	0440	0437	0436	0436	0435	0435	0434	0434
Time (EST)													
0500-0559	1	-	-	-	-	2	-	-	-	-	-	-	-
0600-0659	3	-	1	-	1	1	1	-	5	1	2	1	-
0700-0759	2	3	-	-	-	-	3	2	2	-	2	-	-
0800-0859	-	-	2	-	-	-	2	1	-	5	-	-	-
0900-0959	-	-	-	1	-	-	-	-	-	2	-	-	-
1000-1059	-	-	-	-	-	-	2	1	3	-	-	-	-
1100-1159	-	-	-	-	-	-	3	-	1	1	1	6	-
1200-1259	-	-	-	-	-	-	1	-	-	1	-	2	-
1300-1359	-	-	-	-	-	-	1	-	-	1	2	-	2
1400-1459	-	-	-	-	-	-	-	-	-	2	1	1	-
1500-1559	-	-	-	-	-	-	-	-	-	-	-	1	-
1600-1659	-	-	-	-	-	-	-	-	-	-	1	-	1
1700-1759	-	-	-	-	-	-	-	-	-	-	1	1	-
1800-1859	-	-	-	-	-	-	-	-	-	-	-	2	-
Totals	6	3	3	1	1	3	13	4	11	13	10	14	3

continued

Table 11. Continued.

Date	Jun 2	Jun 3	Jun 5	Jun 6	Jun 8	Jun 9	Jun 10	Jun 17	Jun 20	Jun 24	Jun 30	Total	%
Water Temp.(F)	70	69	70	70	70	70	71	74	76	77	74		
Sunrise(EST)	0433	0433	0432	0432	0431	0431	0431	0430	0431	0432	0434		
Time (EST)													
0500-0559	4	-	2	-	-	-	1	-	1	-	-	11	8.6
0600-0659	-	1	2	1	-	-	-	1	3	-	-	24	18.8
0700-0759	4	-	-	-	2	-	-	-	-	-	-	20	15.6
0800-0859	3	-	-	-	-	3	-	-	-	1	-	17	13.3
0900-0959	4	-	-	-	-	-	-	-	-	-	1	8	6.3
1000-1059	-	-	-	1	-	-	-	-	-	-	-	7	5.5
1100-1159	-	1	-	-	-	-	-	-	-	-	-	13	10.2
1200-1259	1	-	-	-	-	2	-	-	-	-	-	7	5.5
1300-1359	-	-	-	-	-	-	-	-	-	-	-	6	4.7
1400-1459	1	-	-	-	-	-	-	-	-	-	-	5	3.9
1500-1559	-	-	1	-	-	-	-	-	-	-	-	2	1.6
1600-1659	-	-	-	-	-	-	-	-	-	-	-	2	1.6
1700-1759	-	-	-	-	-	1	1	-	-	-	-	4	3.1
1800-1859	-	-	-	-	-	-	-	-	-	-	-	2	1.6
Totals	17	2	5	2	2	6	2	1	4	1	1	128	

Table 12. Comparison of the percentage of American shad (Alosa sapidissima) taken by shore anglers with water temperature 1973 and 1974.

Temperature	1973		1974		Total	
	No.	%	No.	%	No.	%
57	1	0.7	1	2.0	2	1.0
58	4	2.8	3	5.9	7	3.6
59	10	7.0	3	5.9	13	6.7
60	8	5.6	7	13.7	15	7.8
61	33	23.2	8	15.7	41	21.2
62	27	19.0	14	27.5	41	21.2
63	56	39.4	3	5.9	59	30.6
64	3	2.1	0	-	3	1.6
68	0	-	1	2.0	1	0.5
69	0	-	1	2.0	1	0.5
70	0	-	10	19.6	10	5.2
Total	142		51		193	

Table 13. Comparison of the percentage of American shad (Alosa sapidissima) taken by shore anglers with time of day, 1973 and 1974.

Time of Day	1973 No.	1973 %	1974 No.	1974 %
0400-0459	1	0.7	0	-
0500-0559	1	0.7	2	3.9
0600-0659	10	7.0	10	19.6
0700-0759	14	9.9	12	23.5
0800-0859	10	7.0	4	7.8
0900-0959	18	12.7	9	17.6
1000-1059	17	12.0	11	21.6
1100-1159	20	14.1	3	5.9
1200-1259*	11	7.8		
1300-1359	8	5.6		
1400-1459	11	7.8		
1500-1559	13	9.1		
1600-1659	3	2.1		
1700-1759	4	2.8		
1800-1859	1	0.7		
Total	142		51	

* Note: Creel census was not conducted past 1200 hours in 1974.