SUMMARY OF THE OPERATION OF THE CONOWINGO DAM FISH COLLECTION FACILITY DURING THE SPRING OF 1973

by

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FISH FACILITY OPERATION REPORT 2

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INTRODUCTION

An agreement was signed between the Philadelphia Electric Power Company, Susquehanna Electric Company, Pennsylvania Power and Light Company, Metropolitan Edison Company, Safe Harbor Water Power Corporation, State of Maryland, State 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 the Interior through the Susquehanna River Shad Advisory Committee.

The facility was first operated in 1972 (Robbins, 1972). Operation in 1973 was according to procedures outlined in "Operation of the Conowingo Dam Fish Facility," drafted by Timothy W. Robbins (1973) and approved by the Operations Subcommittee (Ralph W. Abele, Pennsylvania Fish Commission, Robert J. Rubelmann, Maryland Fisheries Administration, and Paul R. Nichols, National Marine Fisheries Service) of the Susquehanna Shad Advisory Committee.

The present report summarizes the 1973 operation. Items discussed include (1) schedule of operation, (2) attraction velocity, (3) disposition of catch, (4) a creel census conducted below Conowingo Dam and (5) statistics of the catch of the American shad.

METHODS

Schedule of Operation

The facility was operated from 0400 to 2000 hours daily from 1 April to 15 June. It was originally proposed to maintain this schedule until 30 June (Robbins, 1973). However, by 15 June the hopper hoist mechanism was so worn that the facility could be operated only from 0600 to 1100 hours until 30 June to minimize additional wear. The operation was extended beyond 1100 hours if shad were taken in the last hour of scheduled daily operation. It was not operated from 6 to 15 April due to high river flow and on 5, 12, 31 May and 12, 13 June because of repair work on the hopper hoist mechanism.

The facility was operated at night on an experimental basis (between 2000 and 0400 hours) to determine if shad were available in the tailrace. Night operation was conducted once a week beginning on 20 April and twice a week beginning on 2 May. Collection at night was discontinued after 15 June when problems developed with the hopper hoist mechanism.

The length of fishing time per lift depended upon the relative abundance of fishes. Fishing effort ranged from 5 to 30 minutes during the daytime. Five minute sets were normally used when large numbers of herring were present. Some sets were of 60 minutes duration usually at night, particularly when fish were not abundant.

Attraction Velocity

Past experience showed that attraction velocities were best controlled by changing the depth of the weir gates rather than varying water supply from the service units. Service Units 1 and 2 were operated in such a manner that a relatively constant volume (approximately 265 cfs) was available to create an adequate range of attraction velocities. Service Unit 1 was operated at

approximately 30 to 40% gate (depending on plant load) and Service Unit 2 at 75% gate.

Attraction velocities were measured with a General Oceanics Model 2031 Digital Flowmeter with readout and an EPCO Portable Water Current Meter. Measurements were taken in the holding channel and at each entrance to the facility over the operating range (1 to 13 ft below the elevation of the tailrace) of the weir gates.

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 is operated continuously between mid-April and mid-June (Euston, 1973). The selection of which unit to operate is made by a biologist conducting a surveillance and depends upon relative abundance of fishes in the tailrace. Main Generator Number 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 Number 2 was always one of the units on during regular operation of the Conowingo Hydroelectric Station. However, at times of peak fish abundance in the tailrace, Generator Number 5, 6 or 7 was operated. Complete shutdowns were made at the Conowingo Station after 15 June coinciding with termination of the surveillance program.

Station engineers were requested not to operate Main Generator Number 1 whenever possible, because of potential negative effects of the turbulence produced by the Unit Number 1 discharge. We requested that Unit 1 be operated at reduced gate when it was necessary to use this generator. Turbulence was reduced in the vicinity of the facility entrances through this mode of operation.

At least one service unit (usually Number 1) was operated overnight at approximately 35% gate except during periods of complete plant shutdown to provide a small attraction velocity of less than 2 feet per second through the facility. An attraction velocity of approximately 6 feet per second was established one hour before operation of the facility by operating Service Unit Number 2 at 75% gate. Occassionally it was necessary to operate both service units overnight particularly during periods of high river flow.

Tests to determine the optimum attraction velocity for shad were inconclusive in 1972 (Robbins, 1972). The following testing schedule was used between 16 May and 15 June 1973. Two test periods of 4 hours each were scheduled for each 8 hour shift (0400 to 1200, and 1200 to 2000). Attraction velocities were designated as follows: standard low velocity was established at 6 feet per second; standard high velocity at 7 feet per second; experimental low velocity at 3.5 feet per second; and experimental high velocity at 8.5 feet per second.

The standard high velocity was used, except for two consecutive lifts of experimental high velocity, in the first 4 hours of the morning shift. The standard low velocity and two consecutive lifts of experimental high velocity were used in the last 4 hours. The afternoon shift operated in the first 4 hours with standard low velocity, except for two consecutive lifts of experimental low velocity. Standard high velocity and two lifts of experimental low velocity was utilized the second 4 hours. This procedure was reversed the following day. If shad were taken consistently at one velocity, this velocity was not changed.

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 day and the full-open position on the next. This procedure was carried out from approximately 1 May to 30 June.

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 was noted. All shad were transported above Conowingo Dam except for those that died in transport or were returned to the river with extremely large catches of blueback herring.

Other species were counted when we were confident that 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 but approximately five extremely large catches were subsampled or counted entirely.

Two types of tanks were used to transport shad. One was a large (600 gallon) plywood tank constructed by the Pennsylvania Fish Commission in 1972 and the other was a smaller (460 gallon) fiberglass tank. Both were equipped with oxygen for aeration. The larger tank was used most often. This tank was able to hold approximately 15 or 20 shad for a period of up to 3 hours and allowed shad from up to four lifts to be transported at one time. The small tanks, intended as auxillary systems were used infrequently. All tanks were mounted on trucks.

Length, weight, sex, and age, data were taken from most species collected in the facility.

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. Their catch as counted daily once an hour from 0400 to 2000 hours between 24 April and 15 June. However, spot checks of the anglers catch continued until 30 June.

In addition to hourly counts, a count was taken of the number and position of boats at and 15 minutes after (1) the first of the large units began operation and (2) the last of the large units ceased operation. For boat counts, the tailrace was divided into two sections (east and west) by establishing an imaginary line from Main Generator Number 6 to the tip of Rowland's Island to record any changes in the distribution of boats. Anglers fishing from boats were interviewed at Shure's Landing, a boat launching facility ½-mile below Conowingo Dam.

Catch data of the boat anglers represent only a small fraction of the actual catch since only a portion of the boat anglers observed utilized this facility. Many of the boats are launched from locations further downstream from Conowingo Dam. It is felt that the number of shad counted in the shore anglers catch is close to the actual catch since the census taker periodically observed the activity of anglers in addition to making an hourly check. Additionally, there is only one access point to the shoreline.

RESULTS

Catch

A total of 1,422,865 fish, representing 11 families and 43 species was collected in 1973 (Table 1). The white perch (688,172), blueback herring (354,388), alewife (143,880), and channel catfish (79,576) were most common. A total of 75 adult and 2 juvenile American shad was taken (Table 1; Appendix I, Table 1). The most unusual catch was that of a lake herring (Coregonus artedi) in an early morning lift on 24 May. This is a new species record

Ciscoe

for the Susquehanna River-Chesapeake Bay region.

The anadromous clupeids (alewife, blueback herring, hickory shad, and American shad) made up approximately 29% of the catch and individually accounted for a great deal of the weekly variation in catch composition (Table 1). Generally, peaks of abundance corresponded with distinctly different ranges of water temperature. The alewife run reached a peak in the week of 16-21 April when water temperatures were from 50 to 57 F. Two major peaks occurred in the blueback herring run; one during the week of 22 to 28 April (water temperature 57 to 62 F) and the other in the week of 6 to 12 May (water temperature 58 to 61 F). The largest collection of hickory shad was made in the week of 29 April to 5 May when the water temperature was 55 to 60 F. The American shad was first collected on 24 April at water temperature of 60 F. The last shad was taken on 24 June at a water temperature of 73 F.

American Shad Catch

A total of 75 adult and two yearling American shad was collected between 24 April and 24 June (Table 1). Sixty-four adults were transported above Conowingo Dam. A total of five shad were returned to the river with large catches of blueback herring, and six shad died in the transport tank. 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 and spawning condition of 70 adults was examined. The sex ratio was 1:1. Fifty seven (76.0%) of the specimens were either green or ripe (Table 2).

The establishment of an attraction velocity one hour before start of the operation of the facility did not appear to enhance our ability to collect shad, since they were not taken in the first hour of operation. Large numbers of

white perch and small channel catfish crowded into the facility entrance overnight when one service unit was operated. The numbers of these fish was greatly reduced when the pre-operational attraction velocity was established.

The majority of shad (62.7%) were taken at an attraction velocity of 7 feet per second. Most of the remainder were collected at a velocity of 6 feet per second. Few were taken at velocities of 3.5 and 8.5 feet per second. The data suggest that higher attraction velocities are better than low attraction velocities. However, the data may be misleading since large numbers of shad were not available for attraction. The collection of shad was sporadic and only on 20 June was a relatively large number collected. Also, the experimental design did not consider that shad would be taken primarily from 0500 to 0900 hours (see below). Mode of operation of Conowingo Hydroelectric Station and time of day may be more important factors in determining the catch.

The largest percentage of shad (80%) were collected when none of the large units were operating (Table 3). A total of 51 shad (68%) were taken under the latter conditions when none or only one of the small generators was operating. Some 49.3% of all shad collected were taken when Unit 5 was the only generator operating. A total of 8 shad (10.7%) was taken when all generators were operating.

Most shad (78.6%) were collected before 0800 hours (Table 4; Appendix II, Table 1). Shad were not collected prior to 0400 or after 1800 hours. None were collected during darkness.

Few shad (14.7%) were taken by the facility at or below water temperatures of 65 F (Table 5). The largest catches occurred at 70 (22.7%) and 75 F (20.3%). A total of 52 shad (69.3%) was collected at Conowingo during clear or partly sunny weather. The remainder was taken under overcast or foggy conditions (29.3%) and during light rain (1.3%).

Comparison with 1972

The conditions of generation when shad were caught were similar in 1972 and 1973. In 1972, 79% of the shad were taken when none of the large units (#8-11) were operating (Robbins, 1972) compared to 80% in 1973. The best conditions for collecting shad in both 1972 and 1973 were when four or fewer small generators (#1-7) were operating. A total of 86% of the 1972 catch, and 75.9% of the 1973 catch, was taken under these conditions. The generation of Main Generator Number 1 had similar effects on the catch during both years. A total of 279 American shad (95%) was collected in 1972 when Unit 1 was not operating, compared to 85.3% in 1973.

Shad were taken primarily after sunrise in both years. In 1972, 86.3% of the shad were collected before 0900 hours compared to 81.3% in 1973 (Table 4). However, the largest collections appeared earlier in the day in 1973, i.e., from 0500 to 0700 rather than 0600 to 0900 as in 1972. No shad were caught during darkness in either year. During both years shad were regularly collected only after the water temperature reached 67 F. The largest 1972 collections were made at 70 (39.6%) and 74 F (22.2%) (Robbins, 1972), and in 1973 at 70 F (22.7%) and 75 F (29.3%). A higher percentage (73%) of shad was taken between 68 and 71 F in 1972, than in 1973 (36.0%). In 1973, the water temperature increased rapidly from 67 to 74 F between 5 and 9 June, thus limiting the collection time in the 68 to 71 F range.

Creel Census

Results of the creel census indicate that relatively few shad were taken by anglers in the tailrace in 1973 (Table 6). A total of 142 shad were taken from 24 April through 15 June. The estimate of the catch is based on interviews with anglers fishing from the west shore because we were not able to obtain a reliable estimate of the number of shad taken by anglers fishing from

1973

61.0 - 63.0

boats. Anglers were most successful between 11 and 14 May when they caught 104 shad. The number of shore anglers per hour vary considerable on a daily basis. After 23 May, fishing effort was rather sporadic. Angling effort from boats was greatest on the east side of the tailrace (below the large units) where the count of anglers was 3.8 per hour compared with 1.0 per hour on the west side of the tailrace.

Boat anglers apparently prefer fishing on the west side of the tailrace when no large units (Units 8-11) are operating (Table 7). They prefer the east side when any of the large units are operating. When large units were not generating more boat hours were spent on the west side than on the east side. The distribution of the boats was reversed when one or more of the large units were operating.

Past observations suggest that as the large units came on line, the catch of anglers fishing along the west bank below the facility generally decreased. In the present study, however, the anglers on the west shore caught 73.9% of their shad when the large units were operating (Table 8). A total of 92 shad (64.8%) was caught by anglers when Conowingo Hydroelectric Station was at full generation. Thus shore angler catch does not decrease as larger units go on line.

The results of the creel census suggest 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 day and year, and water temperature. The largest angler catch of shad (119) occured between 59.0 - 63.0° 10 and 15 May. No shad were collected by the facility during this period. All shad caught by anglers were taken at water temperatures of 57 F to 64 F and only 10 (13%) were taken by the facility at these temperatures (Table 5). The majority of shad (85.3%) taken by the facility were collected between 5 and 30 June at water temperatures

of 67 F to 79 F. Shad were taken by anglers regularly between 0600 and 1500 hours but most shad collected in the facility were taken before 0700 hours (Appendix II, Table 1; Appendix III, Table 1). The reasons for the above discrepant results are not clear.

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Table 1. Numbers of fishes taken in the Conowingo Dam Fish Collection Facility from 1 April to 30 June 1973.

Dates	1-7 Apr	16-21 Apr	22-28 Apr	29 Apr 5 May	6-12 May	13-19 May
No. of lifts	90	174	185	164	167	179
Fishing time (hr)	42.5	53.3	75.0	68.9	61.7	72.5
Water temperature (F)	48-51	50-57	57-62	55-60	58-61	59-63
Petromyzontidae						
Petromyzon marinus	1	-	-	1	-	-
Anguillidae						
Anguilla rostrata	1	4	25	6	65	51
Clupeidae						
Alosa aestivalis	-	18,303	97,703	20,034	100,576	55,568
A. mediocris	-	74	186	466	10	-
A. pseudoharengus	1,750	97,037	30,200	13,358	467	529
A. sapidissima	-	-	4	1	-	-
Dorosoma cepedianum	35	486	1,967	1,529	2,175	6,524
Salmonidae						
Salmo gairdneri	-	1	1	-	3	2
S. trutta	6	13	10	11	6	14
Salvelinus fontinalis	-	-	-	-	-	2
Unidentified hybrid	-	-	-	-	-	-
Esocidae						
Esox lucius	-	-	1	-	-	-
E. masquinongy	10	17	42	1	4	4
E. niger	-	-	-	-	-	1

continued

Table 1. Continued.

Dates	20-26 May	27 May 2 June	3-9 June	10-16 June	17-23 June	24-30 June	Total
No. of lifts	157	138	200	83	55	53	
Fishing time (hr)	75.2	66.1	77.2	32.1	17.7	20.4	
Water temperature (F)	57-60	56-65	65-74	75-79	75-79	73-77	
Petromyzontidae							
Petromyzon marinus	-	-	-	-	-	-	2
Anguillidae							
Anguilla rostrata	12	17	699	1,170	48	150	2,248
Clupeidae							
Alosa aestivalis	1,371	1,095	34,747	21,268	2,238	1,485	354,388
A. mediocris	-	2	-	-	-	-	738
A. pseudoharengus	167	37	27	90	117	101	143,880
A. sapidissima	-	5	33	25	2	7*	77*
Dorosoma cepedianum	5,433	2,502	13,407	13,773	6,277	5,995	60,103
Salmonidae							
Salmo gairdneri	32	1	8	20	-	-	68
S. trutta	28	36	107	55	4	10	300
Salvelinus fontinalis	1	-	-	-	-	-	3
Unidentified hybrid	1	1	1	-	-	-	3
	1	-	-	-	-	-	1
Esocidae							
Esox lucius	-	-	1	-	-	-	2
E. masquinongy	2	5	13	6	-	1	105
E. niger	-	-	-	-	-	-	1

continued

* Includes 2 juvenile shad

Table 1. Continued.

Dates	1-7 Apr	16-21 Apr	22-28 Apr	29 Apr 5 May	6-12 May	13-19 May	20-26 May
No. of lifts	90	174	185	164	167	179	157
Fishing time (hr)	42.5	53.3	75.0	68.9	61.7	72.5	75.2
Water temperature (F)	48-51	50-57	57-62	55-60	58-61	59-63	57-60
Cyprinidae							
Carassius auratus	-	-	1	-	-	1	-
Cyprinus carpio	6	2	688	42	281	101	296
Notemigonus crysoleucas	-	-	15	1	23	31	2
Notropis amoenus	-	-	-	-	-	-	-
N. hudsonius	-	-	132	-	-	-	-
N. spilopterus	-	-	-	-	-	-	-
Catostomidae							
Carpiodes cyprinus	2	8	1,313	240	1,277	629	3,951
Catostomus commersoni	122	169	449	11	66	23	10
Erimyzon oblongus	-	-	2	-	-	1	-
Hypentelium nigricans	-	-	1	-	-	1	-
Moxostoma macrolepidotum	4	383	1,008	101	883	334	589
Ictaluridae							
Ictalurus catus	-	-	-	-	-	-	-
I. natalis	-	-	-	-	-	-	-
I. nebulosus	-	-	6	-	124	63	2
I. punctatus	15	6	1,806	26	143	244	226
Percichthydae							
Morone americana	4	332	15,339	23,480	184,536	171,893	54,819
M. saxatilis	-	1	-	-	4	40	17

continued

Table 1. Continued.

Dates	27 May 2 June	3-9 June	10-16 June	17-23 June	24-30 June	Totals
No. of lifts	138	200	83	55	53	
Fishing time (hr)	66.1	77.2	32.1	17.7	20.4	
Water temperature (F)	56-65	65-74	75-79	75-79	73-77	
Cyprinidae						
Carassius auratus	4	20	1	-	-	27
Cyprinus carpio	189	9,879	5,218	2,263	508	19,473
Notemigonus crysoleucas	26	575	57	48	54	832
Notropis amoenus	25	200	30	-	-	255
N. hudsonius	1	4	-	-	-	137
N. spilopterus	1	11	28	-	-	40
Catostomidae						
Carpiodes cyprinus	905	15,871	3,283	880	425	28,784
Catostomus commersoni	41	133	9	-	-	1,033
Erimyzon oblongus	-	-	-	-	-	3
Hypentelium nigricans	-	-	-	-	-	2
Moxostoma macrolepidotum	297	816	4	-	-	4,419
Ictaluridae						
Ictalurus catus	10	3,576	2,816	667	324	7,393
I. natalis	-	45	-	-	-	45
I. nebulosus	7	1,815	3,569	1,492	365	7,443
I. punctatus	1,094	29,875	22,267	14,942	8,932	79,576
Percichthydae						
Morone americana	15,931	156,003	38,477	21,470	5,888	688,172
M. saxatilis	7	119	987	1,937	272	3,384

continued

Table 1. Continued.

Dates	1-7 Apr	16-21 Apr	22-28 Apr	29 Apr 5 May	6-12 May	13-19 May	20-26 May
No. of lifts	90	174	185	164	167	179	157
Fishing time (hr)	42.5	53.3	75.0	68.9	61.7	72.5	75.2
Water temperature (F)	48-51	50-57	57-62	55-60	58-61	59-63	57-60
Centrarchidae							
Ambloplites rupestris	-	-	-	-	-	1	-
Lepomis auritus	-	-	12	-	30	147	7
L. cyanellus	-	-	-	-	-	-	-
L. gibbosus	-	-	1	-	63	25	39
L. macrochirus	-	-	23	26	139	185	20
Micropterus dolomieui	1	7	70	5	51	27	11
M. salmoides	-	24	29	1	4	4	-
Pomoxis annularis	2	-	9	1	3	52	7
P. nigromaculatus	-	-	2	-	-	-	-
Percidae							
Etheostoma olmstedi	1	-	-	-	-	-	-
Perca flavescens	2	-	7	3	54	21	27
Stizostedion vitreum	31	200	867	40	204	278	107
Totals	1,993	117,067	151,919	59,384	291,191	236,796	67,178

continued

Table 1. Continued.

Dates	27 May 2 June	3-9 June	10-16 June	17-23 June	24-30 June	Total
No. of lifts	138	200	83	55	53	1,645
Fishing time (hr)	66.1	77.2	32.1	17.7	20.4	662.6
Water temperature (F)	56-65	65-74	75-79	75-79	73-77	
Centrarchidae						
Ambloplites rupestris	1	22	28	6	3	61
Lepomis auritus	117	693	1,378	606	168	3,158
L. cyanellus	-	-	-	10	1	11
L. gibbosus	178	620	2,406	2,339	1,199	6,870
L. macrochirus	62	478	572	402	197	2,104
Micropterus dolomieui	13	112	1	-	6	304
M. salmoides	1	12	5	-	2	82
Pomoxis annularis	4	262	340	867	816	2,363
P. nigromaculatus	-	2	-	7	32	43
Percidae						
Etheostoma olmstedi	-	-	-	-	-	1
Perca flavescens	34	610	332	27	15	1,132
Stizostedion vitreum	66	546	483	578	399	3,799
Totals	22,715	271,342	118,698	57,227	27,355	1,422,865

Table 2. Sex ratio and spawning condition of American shad (Alosa sapidissima) collected in the Conowingo Dam Fish Collection Facility from 24 April to 24 June 1973.

Date	Water Temp. (F)	Male		Female				Undetermined	Total
		Ri	Sp	Gr	Ri	Part. Sp	Sp		
24 April	60	1	-	-	-	-	-	-	1
25 April	62	-	-	1	-	-	-	2	3
4 May	58	1	-	-	-	-	-	-	1
29 May	58	1	-	-	-	-	-	-	1
1 June	63	1	-	-	-	-	-	-	1
2 June	64	2	-	1	-	-	-	-	3
3 June	65	-	-	1	-	-	-	-	1
5 June	67	3	-	-	-	1	-	-	4
6 June	69	5	-	3	1	1	-	-	10
7 June	70	3	-	3	-	1	1	3	11
8 June	70	4	-	2	-	-	-	-	6
9 June	74	-	-	-	-	-	1	-	1
10 June	75	9	-	9	-	-	2	-	20
11 June	77	1	-	-	-	-	-	-	1
14 June	79	-	-	1	-	-	-	-	1
16 June	79	1	-	-	-	1	1	-	3
21 June	75	-	-	-	-	-	1	-	1
23 June	75	1	-	-	-	-	-	-	1
24 June	73	1	1	1	-	1	1	-	5
Totals		34	1	22	1	5	7	5	75

Table 3. Numbers of American shad (Alosa sapidissima) taken in the Conowingo Dam Fish Collection Facility from 24 April to 24 June 1973 under various conditions of generation of the Conowingo Hydroelectric Station.

No. Units Operating		Unit Numbers	No. of	%
Small	Large	Operating	Shad	Total Catch
0	0	-	10	13.3
1	0	2	3	4.0
1	0	5	37	49.3
1	0	1	1	1.3
3	0	2, 5, 6	5	6.7
3	0	5-7	1	1.3
4	2	3,5-7,9,11	1	1.3
4	3	2,5-9,11	1	1.3
4	3	2,5-7,9-11	1	1.3
4	4	1,2,5,7-11	2	2.7
5	3	2,4-9,11	1	1.3
5	4	2,4-11	1	1.3
7	4	1-11	8	10.7
Changing		Changing	3	4.0
Total	-	-	75	-

Table 4. Time of day at which the American shad (Alosa sapidissima) was taken in the Conowingo Dam Fish Collection Facility in 1972 and 1973.

Time Taken (EST)	1972	1973	% (1972)	% (1973)
0300-0359	-	-	-	-
0400-0459	-	6	-	8.0
0500-0559	10	25	3.4	33.3
0600-0659	113	22	38.6	29.3
0700-0759	66	6	22.5	8.0
0800-0859	64	2	21.8	2.7
0900-0959	5	1	1.7	1.3
1000-1059	2	2	0.7	2.7
1100-1159	1	2	0.3	2.7
1200-1259	3	2	1.0	2.7
1300-1359	7	1	2.4	1.3
1400-1459	4	0	1.4	-
1500-1559	-	2	-	2.7
1600-1659	3	2	1.0	2.7
1700-1759	9	2	3.1	2.7
1800-1859	6	0	2.0	-
1900-1959	-	-	-	-
Total	293	75	-	-

Table 5. Water temperatures at which the American shad (Alosa sapidissima) was taken by shore anglers and by the Conowingo Dam Fish Collection Facility from 24 April to 24 June 1973.

Temp. °F	Angler Catch	Facility Catch	% Angler Catch	% Facility Catch
57	1	-	0.7	-
58	4	2	2.8	2.7
59	10	-	7.0	-
60	8	1	5.6	1.3
61	33	-	23.2	-
62	27	3	19.0	4.0
63	56	1	39.4	1.3
64	3	3	2.1	4.0
65	-	1	-	1.3
66	-	-	-	-
67	-	4	-	4.3
68	-	4	-	-
69	-	10	-	13.3
70	-	17	-	22.7
71	-	-	-	-
72	-	-	-	-
73	-	5	-	6.7
74	-	1	-	1.3
75	-	22	-	29.3
76	-	-	-	-
77	-	1	-	1.3
78	-	-	-	-
79	-	4	-	5.3
Total	142	75	-	-

Table 6. Estimates of total fishing effort for shore and boat anglers at the Conowingo Dam Tailrace from 24 April to 15 June 1973.

Date	Shore Anglers (avg/hr)	Total Shore Angler-Hours	Shad Observed Caught	Boat Anglers East side (avg/hr)	Total Boat Angler-hours East side	Boat Anglers West side (avg/hr)	Total Boat Angler-hours West side
24 April	41	656	5	2	36	0	0
25 April	34	546	2	1	16	0	2
26 April	37	594	0	1	16	0	0
27 April	25	405	1	1	8	0	0
28 April	68	1090	3	5	75	1	11
29 April	61	982	0	3	40	4	70
30 April	22	358	0	0	3	0	0
1 May	24	387	0	2	32	0	2
2 May	37	585	0	2	30	0	1
3 May	23	371	0	2	27	0	0
4 May	27	363	1	3	55	0	0
6 May	81	1288	0	7	112	11	176
7 May	32	514	0	1	22	0	3
8 May	26	421	0	5	83	0	6
9 May	26	422	0	3	49	0	6
10 May	40	635	9	6	88	1	13
11 May	42	666	30	5	75	0	4
12 May	75	1206	24	25	397	4	59
13 May	68	1090	32	4	56	8	128
14 May	38	608	18	6	90	0	0
15 May	34	542	6	5	85	0	0
16 May	28	450	0	5	80	1	10
17 May	16	258	2	8	46	1	9
18 May	14	223	1	2	28	0	4

continued

Table 6. Continued.

Date	Shore Anglers (avg/hr)	Total Shore Angler-Hours	Shad Observed Caught	Boat Anglers East side (avg/hr)	Total Boat Angler-hours East side	Boat Anglers West side (avg/hr)	Total Boat Angler-hours West side
19 May	41	654	0	15	243	6	101
20 May	29	458	0	2	27	2	32
21 May	14	229	3	3	47	0	0
22 May	17	279	0	4	56	0	2
23 May	12	189	0	2	37	0	6
24 May	7	114	0	1	13	0	0
25 May	7	110	1	3	54	0	0
26 May	25	402	0	7	106	1	14
27 May	11	183	1	1	22	0	6
28 May	21	328	0	0	7	0	0
29 May	5	79	0	2	32	1	15
30 May	6	94	0	1	17	0	2
31 May	10	160	0	2	37	0	0
1 June	7	139	0	1	20	0	3
2 June	26	418	3	6	89	1	12
3 June	27	426	0	5	83	1	21
4 June	5	81	0	1	22	0	0
5 June	10	155	0	3	41	0	0
6 June	5	87	0	2	27	0	0
7 June	7	119	0	4	57	0	0
8 June	14	217	0	5	74	0	2
9 June	20	321	0	6	98	3	42
10 June	21	328	0	4	67	2	35
11 June	5	86	0	4	64	0	0
14 June	7	110	0	1	10	1	10
15 June	4	69	0	0	0	1	11
Total		20,495	142		2899		818
Average per day	26	409.9	2.8	3.8	58	1	16.4

Table 7. The distribution of boats in the tailrace of Conowingo Dam, under various conditions of generation of Conowingo Hydroelectric Station, 24 April to 15 June 1973.

No. Units Operating		No. Boat-hrs	No. Boat-hrs	%	%
Small	Large	(East side)	(West side)	(East side)	(West side)
1	0	21	15	58.3	41.7
2	0	6	16	27.3	72.7
3	0	6	14	30.0	70.0
4	0	22	32	40.7	59.3
5	0	0	6	-	100.0
0	1	3	0	100.0	-
3	1	3	2	60.0	40.0
4	1	39	38	50.6	49.4
3	2	1	1	50.0	50.0
4	2	35	33	51.5	48.5
5	2	4	1	80.0	20.0
6	2	2	0	100.0	-
3	3	2	0	100.0	-
4	3	31	8	79.5	20.5
5	3	30	4	88.2	11.8
6	3	1	0	100.0	-
7	3	7	1	87.5	12.5
3	4	9	4	69.2	30.8
4	4	38	5	88.4	11.6
5	4	25	4	86.2	13.8
6	4	22	1	95.7	4.3
7	4	804	129	86.2	13.8
Changing		40	3	93.0	7.0
Total		1151	317	78.4	21.6

Table 8. Status of generation of Conowingo Hydroelectric Station in relation to shore angler catch of American shad (Alosa sapidissima) from 24 April to 2 June 1973.

No. Units Operating		Unit Numbers	No. of	%
Small	Large	Operating	Shad	Total Catch
1	0	2	10	7.0
4	1	2,5-7,11	1	0.7
4	2	2,5-8,11	2	1.4
3	3	1,2,5,8-11	1	0.7
4	3	2,5-9,11	1	0.7
4	4	1,2,5,6,8-11	1	0.7
5	4	1,2,5-11	1	0.7
5	4	2,4-11	1	0.7
6	4	1,2,4-11	1	0.7
7	3	1-9,11	2	1.4
7	4	1-11	92	64.8
Changing		Changing	5	3.5
Undetermined		-	24	16.9
Total	-	-	142	-

APPENDIX I

Table 1. Numbers of American shad (*Alosa sapidissima*) taken in the Conowingo Dam Fish Collection Facility from 24 April to 24 June 1973 and data describing conditions for each lift.

Table 1. Numbers of American shad (Alosa sapidissima) taken in the Conowingo Dam Fish Collection Facility from 24 April to 24 June 1973 and data describing conditions for each lift.

Date	24 April	25 April		4 May	29 May	1 June
Lift Number	2	5	8	20	10	17
PARAMETERS *						
Shad Taken	1	1	2	1	1	1
Total Fish	10,001	6,721	10,322	289	98	41
Rel. Loc.	1	1	2	1	1	1
Lift Time	0459	0610	0740	1230	1000	1534
Min. Fished	30	15	15	15	30	30
Air Temp.	51	52	53	52	77	79
Water Temp.	60	62	62	58	58	63
Weather	1	3	3	2	2	1
At. Pressure	29.70	29.80	29.80	29.73	29.68	29.97
Small Gen. on	1	1	1	7	7	7
Large Gen. on	0	0	0	4	4	4
Unit 1	2	2	2	1	1	1
Unit 2	2	1	1	1	1	1
Spill gates open	0	0	0	0	0	0
River Flow	88.4	77.7	77.7	51.8	86.6	66.2
% Gate S.U. 1	35	35	35	35	35	35
% Gate S.U. 2	75	75	75	75	75	75
Vel. Hld. Chan.	-	-	-	1.8	1.5	1.5
Vel. Weir 1	-	-	-	6.4	3.5	6.0
Vel. Weir 2	-	-	-	5.2	3.5	6.0
Weir Gates open	3	3	3	3	3	3
Ft. Below TR	-	-	-	-	-	-
Weir 1	6.0	5.0	5.0	6.0	10.5	6.5
Weir 2	6.0	5.0	5.0	6.0	10.5	6.5
Tailrace Elev.	14.3	14.1	14.1	20.5	20.8	20.6
Hld. Chan. Elev.	14.9	15.0	15.0	21.5	21.4	21.7
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	2	1	1	1

continued

* See Legend

Table 1. Continued.

Date	2 June			3 June	5 June	
Lift Number	8	21	23	13	5	6
PARAMETERS						
Shad Taken	1	1	1	1	1	2
Total Fish	60	57	48	337	6,901	686
Rel. Loc.	1	1	1	1	1	1
Lift Time	0620	1547	1712	1221	0530	0600
Min. Fished	30	30	30	30	30	15
Air Temp.	59	76	76	74	65	66
Water Temp.	64	64	64	65	67	67
Weather	1	2	2	2	2	2
At. Pressure	29.96	30.00	30.00	30.10	30.05	30.05
Small Gen. on	4	4	4	7	1	1
Large Gen. on	2	4	4	4	0	0
Unit 1	2	1	1	1	2	2
Unit 2	2	1	1	1	2	2
Spill gates open	0	0	0	0	0	0
River Flow	57.0	57.0	57.0	52.5	43.9	43.9
% 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	1.5	1.5	1.5
Vel. Weir 1	7.0	7.0	7.0	7.0	6.0	6.0
Vel. Weir 2	7.0	7.0	7.0	7.0	6.0	6.0
Weir Gates open	3	3	3	3	3	3
Ft. Below TR	-	-	-	-	-	-
Weir 1	5.5	5.5	5.5	5.5	6.5	6.5
Weir 2	5.5	5.5	5.5	5.5	6.5	6.5
Tailrace Elev.	18.4	19.7	19.7	20.5	14.1	14.1
Hld. Chan. Elev.	19.0	20.4	20.4	21.4	14.7	14.7
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	2	1	1	1

continued

Table 1. Continued.

Date	5 June	6 June				
Lift Number	7	3	4	5	6	7
PARAMETERS						
Shad Taken	1	1	2	1	3	3
Total Fish	3,591	1,385	8,642	6,821	6,787	6,253
Rel. Loc.	1	1	1	1	1	1
Lift Time	0630	0435	0520	0550	0620	0650
Min. Fished	15	30	30	15	15	15
Air Temp.	66	68	68	69	70	72
Water Temp.	67	69	69	69	69	69
Weather	2	1	1	2	2	1
At. Pressure	30.05	30.02	30.02	30.04	30.04	30.04
Small Gen. on	1	1	1	1	1	1
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	43.9	42.5	42.5	42.5	42.5	42.5
% 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	1.5	1.5	1.5
Vel. Weir 1	6.0	7.0	7.0	7.0	7.0	7.0
Vel. Weir 2	6.0	7.0	7.0	7.0	7.0	7.0
Weir Gates open	3	3	3	3	3	3
Ft. Below TR	-	-	-	-	-	-
Weir 1	6.5	5.5	5.5	5.5	5.5	5.5
Weir 2	6.5	5.5	5.5	5.5	5.5	5.5
Tailrace Elev.	14.1	14.1	14.1	14.1	14.1	14.1
Hld. Chan. Elev.	14.7	14.8	14.8	14.8	14.8	14.8
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	1	2	2	2	2	2

continued

Table 1. Continued.

Date	7 June						
Lift Number	8	10	10	11	11	22	26
PARAMETERS							
Shad Taken	1	1	1	5	1	1	1
Total Fish	10,262	14,282	-	9,006	-	285	214
Rel. Loc.	2	1	2	1	2	1	1
Lift Time	0525	0615	-	0640	-	1418	1708
Min. Fished	15	10	-	10	-	30	30
Air Temp.	68	69	-	70	-	77	80
Water Temp.	70	70	-	70	-	70	70
Weather	3	3	-	3	-	2	2
At. Pressure	30.00	30.03	-	30.00	-	30.05	30.05
Small Gen. on	1	1	-	1	-	7	4
Large Gen. on	0	0	-	0	-	4	3
Unit 1	2	2	-	2	-	1	1
Unit 2	2	2	-	2	-	1	1
Spill gates open	0	0	-	0	-	0	0
River Flow	44.5	44.5	-	44.5	-	44.5	44.5
% Gate S.U. 1	35	35	-	35	-	35	35
% Gate S.U. 2	75	75	-	75	-	75	75
Vel. Hld. Chan.	1.5	1.5	-	1.5	-	1.5	1.5
Vel. Weir 1	6.0	6.0	-	6.0	-	8.5	8.5
Vel. Weir 2	6.0	6.0	-	6.0	-	8.5	8.5
Weir Gates open	3	3	-	3	-	3	3
Ft. Below TR	-	-	-	-	-	-	-
Weir 1	6.5	6.5	-	6.5	-	4.5	4.5
Weir 2	6.5	6.5	-	6.5	-	4.5	4.5
Tailrace Elev.	14.1	14.1	-	14.1	-	20.8	20.2
Hld. Chan. Elev.	14.7	14.7	-	14.7	-	21.8	21.2
Crowder Position	1	1	-	1	-	1	1
Cr. Gate Position	1	1	-	1	-	1	1

continued

Table 1. Continued.

Date	8 June				9June	10 June
Lift Number	4	6	7	14	16	4
PARAMETERS						
Shad Taken	1	1	3	1	1	2
Total Fish	3,489	209	1,533	601	94	5,671
Rel. Loc.	1	1	1	1	1	1
Lift Time	0450	0550	0620	1035	1150	0530
Min. Fished	15	15	15	15	30	30
Air Temp.	65	67	66	78	90	74
Water Temp.	70	70	70	70	74	75
Weather	2	6	6	2	2	1
At. Pressure	30.11	30.15	30.11	30.18	30.00	29.95
Small Gen. on	3	3	3	7	5	1
Large Gen. on	0	0	0	4	4	0
Unit 1	2	2	2	1	2	2
Unit 2	1	1	1	1	1	2
Spill gates open	0	0	0	0	0	0
River Flow	53.8	53.8	53.8	53.8	50.2	45.8
% 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	7.0	7.0	7.0	8.5	7.0	7.0
Vel. Weir 2	7.0	7.0	7.0	8.5	7.0	7.0
Weir Gates open	3	3	3	3	3	3
Ft. Below TR	-	-	-	-	-	-
Weir 1	5.5	5.5	5.5	4.5	5.5	5.5
Weir 2	5.5	5.5	5.5	4.5	5.5	5.5
Tailrace Elev.	15.7	15.7	15.7	20.7	20.0	14.1
Hld. Chan. Elev.	16.3	16.3	16.3	22.0	20.0	14.8
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	2	2	1	2

continued

Table 1. Continued.

Date	10 June						
Lift Number	4	5	5	7	8	9	15
PARAMETERS							
Shad Taken	5	5	1	1	1	1	1
Total Fish	-	2,310	-	1,346	2,114	713	151
Rel. Loc.	2	1	2	1	1	1	1
Lift Time	-	0600	-	0657	0725	0755	1110
Min. Fished	-	15	-	15	15	15	15
Air Temp.	-	74	-	76	78	79	87
Water Temp.	-	75	-	75	75	75	75
Weather	-	1	-	1	1	1	1
At. Pressure	-	29.95	-	29.95	29.95	30.00	30.00
Small Gen. on	-	1	-	1	9	3	4
Large Gen. on	-	0	-	0	0	0	3
Unit 1	-	2	-	2	2	2	2
Unit 2	-	2	-	2	2	2	1
Spill Gates open	-	0	-	0	0	0	0
River Flow	-	45.8	-	45.8	45.8	45.8	45.8
% Gate S.U. 1	-	35	-	35	35	35	35
% Gate S.U. 2	-	75	-	75	75	75	75
Vel. Hld. Chan.	-	1.5	-	1.5	1.5	1.5	1.5
Vel. Weir 1	-	7.0	-	7.0	99.9	7.0	8.5
Vel. Weir 2	-	7.0	-	7.0	99.9	7.0	8.5
Weir Gates open	-	3	-	3	3	3	3
Ft. Below TR	-	-	-	-	-	-	-
Weir 1	-	5.5	-	5.5	99.9	5.5	4.5
Weir 2	-	5.5	-	5.5	99.9	5.5	4.5
Tailrace Elev.	-	14.1	-	14.1	99.9	15.5	18.5
Hld. Chan. Elev.	-	14.8	-	14.8	99.9	16.2	20.1
Crowder Position	-	1	-	1	1	1	1
Cr. Gate Position	-	2	-	2	2	2	2

continued

Table 1. Continued.

Date	10 June		11 June	14 June	16 June	
Lift Number	17	26	6	8	4	5
PARAMETERS						
Shad Taken	1	2	1	1	1	2
Total Fish	157	489	457	1,665	12,001	5,410
Rel. Loc.	1	1	1	1	1	1
Lift Time	1240	1830	0615	0830	.0453	0522
Min. Fished	30	35	15	30	15	10
Air Temp.	87	81	73	76	65	65
Water Temp.	75	75	77	79	79	79
Weather	1	1	1	1	1	1
At. Pressure	29.95	29.90	29.91	29.95	29.80	29.80
Small Gen. on	5	7	9	9	0	0
Large Gen. on	3	4	0	0	0	0
Unit 1	2	1	2	2	2	2
Unit 2	1	1	1	1	2	2
Spill Gates open	0	0	0	0	0	0
River Flow	45.8	45.8	40.9	29.3	29.1	29.1
% Gate S.U. 1	35	35	35	35	0	0
% 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	6.0	7.0	99.9	99.9	5.5	5.5
Vel. Weir 2	6.0	7.0	99.9	99.9	5.5	5.5
Weir Gates open	3	3	3	3	3	3
Ft. Below TR	-	-	-	-	-	-
Weir 1	6.5	5.5	99.9	99.9	5.2	5.2
Weir 2	6.5	5.5	99.9	99.9	5.2	5.2
Tailrace Elev.	19.4	20.4	99.9	99.9	12.2	12.2
Hld. Chan. Elev.	20.1	21.7	99.9	99.9	-	-
Crowder Position	1	1	1	1	1	1
Cr. Gate Position	2	2	1	2	2	2

continued

Table 1. Continued.

Date	21 June	23 June	24 June		
Lift Number	4	3	3	5	7
PARAMETERS					
Shad Taken	1	1	2	2	1
Total Fish	117	421	386	192	216
Rel. Loc.	1	1	1	1	1
Lift Time	0710	0630	0625	0755	0915
Min. Fished	30	30	30	30	30
Air Temp.	72	67	68	69	72
Water Temp.	75	75	73	73	73
Weather	4	6	3	3	3
At. Pressure	30.10	30.00	29.96	29.97	29.97
Small Gen. on	0	0	0	0	0
Large Gen. on	0	0	0	0	0
Unit 1	2	2	2	2	2
Unit 2	2	2	2	2	2
Spill gates open	0	0	0	0	0
River Flow	22.5	26.5	29.4	29.4	29.4
% Gate S.U. 1	30	30	30	30	30
% Gate S.U. 2	75	75	75	75	75
Vel. Hld. Chan.	1.5	1.5	1.5	1.5	1.5
Vel. Weir 1	7.0	7.0	7.0	7.0	7.0
Vel. Weir 2	7.0	7.0	7.0	7.0	7.0
Weir Gates open	3	3	3	3	3
Ft. Below TR	-	-	-	-	-
Weir 1	5.1	5.1	5.3	5.3	5.3
Weir 2	5.1	5.1	5.3	5.3	5.3
Tailrace Elev.	12.1	12.1	12.3	12.3	12.3
Hld. Chan. Elev.	13.1	13.1	13.4	13.4	13.4
Crowder Position	1	1	1	1	1
Cr. Gate Position	1	1	2	2	2

LEGEND FOR TABLE

Parameter	Abbreviations	Code/ Explanation
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.	°F
Water Temperature	Water Temp.	°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

APPENDIX II

Table 1. Date and time of collection for American shad, *Alosa sapidissima*, taken in the Conowingo Dam Fish Collection Facility from 24 April to 24 June 1973.

Table 1. Date and time of collection for American shad, Alosa sapidissima taken in the Conowingo Dam Fish Collection Facility from 24 April to 24 June 1973.

DATE	April 24	April 25	May 4	May 29	June 1	June 2	June 3	June 5	June 6	June 7	June 8	June 9
Water Temp.(F)	60	62	58	58	63	64	65	67	69	70	70	74
Sunrise(EST)	0514	0513	0502	0439	0438	0437	0437	0437	0436	0436	0436	0436
TIME (EST)												
0300-0359	-	-	-	-	-	-	-	-	-	-	-	-
0400-0459	-	-	-	-	-	-	-	-	3	-	-	-
0500-0559	-	1	-	-	-	1	-	3	1	1	1	-
0600-0659	-	-	-	-	-	-	-	1	6	8	3	-
0700-0759	-	-	-	-	-	-	-	-	-	-	-	-
0800-0859	-	-	-	-	-	-	-	-	-	-	-	-
0900-0959	-	-	-	1	-	-	-	-	-	-	-	-
1000-1059	-	-	-	-	-	-	-	-	-	-	-	-
1100-1159	-	-	-	-	-	-	1	-	-	-	-	1
1200-1259	-	-	1	-	-	-	-	-	-	-	-	-
1300-1359	-	-	-	-	-	-	-	-	-	1	-	-
1400-1459	-	-	-	-	-	-	-	-	-	-	-	-
1500-1559	-	-	-	-	1	1	-	-	-	-	-	-
1600-1659	-	-	-	-	-	1	-	-	-	1	-	-
1700-1759	-	-	-	-	-	-	-	-	-	-	-	-
1800-1859	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS	1	3	1	1	1	3	1	4	10	11	6	1

Table 1. Continued.

DATE	June 10	June 11	June 14	June 16	June 21	June 23	June 24	Totals	%
Water Temp(F)	75	77	79	79	75	75	73		
Sunrise(EST)	0436	0435	0435	0435	0436	0437	0437		
TIME (EST)									
0300-0359	-	-	-	-	-	-	-	0	0.0
0400-0459	-	-	-	1	-	-	-	6	8.0
0500-0559	13	-	-	2	-	-	2	25	33.33
0600-0659	1	1	-	-	1	1	-	22	29.33
0700-0759	2	-	-	-	-	-	2	6	8.0
0800-0859	-	-	1	-	-	-	1	2	2.67
0900-0959	-	-	-	-	-	-	-	1	1.33
1000-1059	1	-	-	-	-	-	-	2	2.67
1100-1159	-	-	-	-	-	-	-	2	2.67
1200-1259	1	-	-	-	-	-	-	2	2.67
1300-1359	-	-	-	-	-	-	-	1	1.33
1400-1459	-	-	-	-	-	-	-	0	-
1500-1559	-	-	-	-	-	-	-	2	2.67
1600-1659	-	-	-	-	-	-	-	2	2.67
1700-1759	2	-	-	-	-	-	-	2	2.67
1800-1859	-	-	-	-	-	-	-	0	0.00
TOTALS	20	1	1	3	1	1	5	75	

APPENDIX III

Table 1. Date and time of catch of American shad, Alosa sapidissima by shore anglers in the Conowingo Dam Tailrace from 24 April to 2 June 1973.

Table 1. Date and time of catch of American shad, Alosa sapidissima, by shore anglers in the Conowingo Dam Tailrace from 24 April to 2 June 1973.

DATE	April 24	April 25	April 27	April 28	May 4	May 10	May 11	May 12	May 13	May 14	May 15	May 17
Water Temp(F)	60	62	62	61	58	59	61	62	63	63	63	60
Sunrise(EST)	0514	0513	0510	0509	0502	0455	0454	0453	0452	0451	0450	0448
TIME												
0300-0359	-	-	-	-	-	-	-	-	-	-	-	-
0400-0459	-	-	-	-	-	-	-	-	-	1	-	-
0500-0559	-	-	-	-	-	-	-	-	-	1	-	-
0600-0659	-	-	-	-	-	-	6	-	2	1	-	-
0700-0759	-	-	-	-	-	1	1	3	4	2	2	-
0800-0859	-	-	-	-	-	1	1	1	4	1	-	-
0900-0959	-	-	-	2	-	-	6	1	3	2	2	-
1000-1059	-	-	-	-	-	1	3	2	11	-	-	-
1100-1159	-	-	-	-	-	-	3	7	1	6	1	1
1200-1259	1	-	-	-	-	-	-	4	2	2	1	1
1300-1359	1	-	1	-	1	1	-	1	1	1	-	-
1400-1459	1	1	-	-	1	2	4	2	1	-	-	-
1500-1559	1	-	-	-	-	2	5	3	-	1	-	-
1600-1659	-	-	-	-	-	-	1	-	2	-	-	-
1700-1759	1	1	-	-	-	1	-	-	1	-	-	-
1800-1859	-	-	-	1	-	-	-	-	-	-	-	-
TOTALS	5	2	1	3	1	9	30	24	32	18	6	2
	61.5	62.6	62.6	57.5	58	59.0	60.8	62.6	63.5	61.7	60	59

Table 1. Continued

DATE	May 18	May 21	May 25	May 27	June 2	Totals	% Total Catch
Water Temp(F)	60	58	59	57	64		
Sunrise(EST)	0448	0445	0442	0441	0437		
TIME							
0300-0359	-	-	-	-	-	-	-
0400-0459	-	-	-	-	-	1	0.70
0500-0559	-	-	-	-	-	1	0.70
0600-0659	-	-	-	1	-	10	7.04
0700-0759	-	-	-	-	1	14	9.86
0800-0859	-	2	-	-	-	10	7.04
0900-0959	-	1	-	-	1	18	12.68
1000-1059	-	-	-	-	-	17	11.97
1100-1159	-	-	-	-	1	20	14.08
1200-1259	-	-	-	-	-	11	7.75
1300-1359	1	-	-	-	-	8	5.63
1400-1459	-	-	-	-	-	11	7.75
1500-1559	-	-	1	-	-	13	9.15
1600-1659	-	-	-	-	-	3	2.11
1700-1759	-	-	-	-	-	4	2.82
1800-1859	-	-	-	-	-	1	0.70
TOTALS	1	3	1	1	3	142	
	58	57.2	57.2	55.5	64.4		