SUMMARY OF THE OPERATION OF THE CONOWINGO DAM FISH COLLECTION FACILITY DURING THE SPRING OF 1979

by

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FISH FACILITY OPERATION REPORT 8

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INTRODUCTION

The Conowingo Dam Fish Collection Facility began operation in 1972 as part of an overall program related to anadromous fish restoration to the Susquehanna River. At about the same time a committee was established to guide development and operation of the program. In 1978, this committee was reorganized into two separate bodies which together form the Susquehanna River Anadromous Fish Restoration Committee; a Policy Committee is responsible for annual program review and appraisal and a Technical Committee is responsible for determination of operational methods and parameters. Representatives from the states of Maryland, New York and the Commonwealth of Pennsylvania, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Federal Energy Regulatory Commission, Susquehanna River Basin Commission, and Philadelphia Electric Company (PECO); Pennsylvania Power and Light Company (PP&L) and Metropolitan Edison Company (MET ED) co-operate in various efforts related to the program.

A formal five year agreement concerning operation of the fish collection facility terminated in 1976. Upon recommendation of the Restoration Committee, Philadelphia Electric Company and its subsidiary, Susquehanna Electric Company (SECO) have agreed to fund and operate the facility on a year to year basis. Guidelines for anadromous fish studies are detailed in the Technical Committee report of 20 March 1979. Segments dealing with the fish collection facility were funded by PECO and

operated following report guidelines. Results of facility operation from 1972 to 1977 are summarized in McGhan (1977). The 1978 results are detailed in McGhan (1978).

METHODS

Schedule of Operation

An attempt was made to begin 1979 operation on 15 April. However, trash accumulated on crowder doors preventing forward movement of the mechanism, thus operations were postponed until 17 April. Normal operation (sunrise to 1200 EST) proceeded on alternate days through 16 June. This schedule allowed for close monitoring of the population of fishes below Conowingo Dam. When sufficient numbers of alosids (alewife, blueback herring and American shad) were collected, operation commenced on a daily basis. Minimum criteria for daily operation was collection of 5 or more American shad and/or 500 or more alewife or blueback herring per day.

Operations were suspended on 25 May due to mechanical failure of the hopper and traveler mechanisms during the clean-out lift. Normal operations resumed on 2 June. With this one exception, few mechanical problems were encountered. River flows never threatened operations (Table 1).

The fishing cycle as described in the Operation and Maintenance Manual (1972) was used in 1979. This necessitated closing the crowder doors for 10 minutes between fishing periods. Fishing time (or set) is defined as that period in which the crowder doors are open. This period will range from 1 to 60

minutes depending upon abundance of fishes. Thirty-minute sets were most commonly used. An intermediate crowder gate position (12 in. opening) was used throughout the season.

As recommended by the Technical Committee, a maximum velocity of 6.0 fps and high flow condition was maintained throughout the season. Weir and service unit gate settings are presented in Table 2. Velocity and flow may have varied slightly since service unit output is controlled by electrical demand.

An agreement between the State of Maryland and the Susquehanna Electric Company states that continuous operation of one of the smaller units at 5,000 cfs during anadromous fish runs may be required. Unit No. 2 was operated to enhance attraction of fish along the west bank of the tailrace. Station engineers were also requested not to operate Unit No. 1 to reduce turbulence near the entrance of the facility.

Disposition of Catch

Basic methods for handling fishes were identical to those used previously (McGhan, 1977). Most catches were counted or subsampled and released to the tailrace. When mortalities due to dissolved oxygen deficiency were likely, catches were quickly estimated and released.

No attempt was made to transport anadromous fishes above Conowingo Dam. No special handling of these species was implemented with the exception of fin-clipping American shad. In addition, sex, length and spawning condition was determined and scale samples were taken. Weights of American shad which died

prior to release were also recorded. Depending upon their condition, all shad were released directly to the tailrace or at Shures Landing.

Length, weight, sex and scale samples were taken from blueback herring and important resident species. Common names of fishes are used throughout the text and tables. A list of common and scientific names is given in Table 3.

CREEL CENSUS

A creel census was conducted below Conowingo Dam to quantify fishing effort and total catch of American shad along the west shore of the tailrace. The census was conducted on an hourly basis during normal operation of the facility (sunrise to 1200 EST). Data include hourly catch, number of shad anglers, angler residence, total hours fished, number and species caught, and number of units operating. Length, sex, and scale samples were taken from shad whenever possible. Angler interviews were also conducted at the end of the normal census day. Anglers observed leaving the area prior to 1200 EST were interviewed as well.

Monitoring distribution of angler boats in relation to number and size of units operating continued in 1979. The tailrace was divided into east and west sections by an imaginary line drawn from Unit No. 6 to the northern tip of Rowland Island. Distribution of boats, number of anglers per boat and generation levels were noted hourly. Angler boat distribution may reflect shad distribution in the tailrace during operational changes. The census began 17 April and continued through 12 June.

RESULTS

The season catch totaled 197,768 fishes representing 11 families and 37 species (Tables 4 and 5). There were 301 lifts with a total fishing time of 131.4 hours. Predominate species were gizzard shad (38.2%), white perch (21.8%), channel catfish (19.3) and carp (7.6%). Anadromous clupeids (alewife, blueback herring and American shad) represented 1.2% of the catch. The clupeid catch has steadily declined since 1973 when all anadromous clupeids comprised 35.1% of the total catch.

It was estimated that the 1979 operation schedule would collect approximately 89% of all anadromous fish expected to be collected under continuous operation (Table 6). This was derived by applying the 1979 mode of operation to 1977 data (the last year of continuous operation). Thus, 1979 catch of blueback herring (2,282) can be expanded to an estimated 2,553. Estimates in Table 6 are probably conservative since anadromous fish runs have changed over the last few years. This change is a reflection of decreased herring and shad populations. Duration of past runs ranged from three to six days and large numbers were collected in the facility. Additionally, there usually were two to three major blueback herring runs. Since 1973 these patterns have gradually changed. In 1979 there was only one substantial run of blueback herring. It occurred on the clean out lift of 30 April and resulted in a catch of 1,504 herring. The facility operated on days immediately before and after 30 April but few herring were collected. At no other time were more than a few dozen herring collected per lift. These changes are considered

herein when estimating the 1979 catch using the continuous operational mode. It is reasonable to expand the 1979 anadromous fish catch by a factor of two.

The hickory shad was absent from the 1979 catch. It has not been taken in the facility since 1975. The catch of alewife decreased to a total of 9. This is the second year that fewer than 10 alewife were captured. This catch has declined from the 1973 catch of 143,880.

American Shad Catch

A total of 49 American shad was collected between 27 April and 14 June. Four shad died prior to release. A male shad fin-clipped on 13 May was recaptured on 18 May.

The sex ratio of shad examined was 0.69 male to 1.00 female (Table 7). All males were ripe and 16 of 29 females were green. No ripe females were observed.

Frequency of capture was sporadic and no relationship to specific collecting conditions could be determined. Eight years of data indicate that most shad are taken at water temperatures of 68 to 75 F (Table 8). Conditions of generation associated with shad collection indicate that most are taken at zero generation or when one small unit and no large units are operating (Table 9). Peak hourly catch of shad occurred between 0600 and 0900 EST (Table 10).

Age determinations were made on 49 American shad collected in the facility and 19 shad taken by anglers. Few three or four year olds were collected. Four year olds were the dominant age

class prior to 1977. Since then, five year old fish have become dominant (Table 11).

Morpholine was released from the facility during a 24 hour period every tenth day of operation in an attempt to attract shad to the facility. This chemical agent has been used to imprint larval shad at the Van Dyke Hatchery (Pennsylvania Fish Commission, Thompsontown, Pa.) since 1976. It was hoped that three year old shad from Van Dyke would be attracted to the facility. One three year old was collected but on a day that morpholine was not used. The most shad collected in one day was 10, on 29 April, a day that morpholine was released. Since few shad were taken on other morpholine release dates (Table 10) this may be coincidental. Definitive statements cannot be made since shad from the hatchery operation cannot be distinguised from those resulting from natural production below the dam.

Creel Census

From 17 April to 12 June anglers caught 19 American shad along the west shore of the tailrace (Table 12). Shore angler effort averaged 16.1 hours per day, and the catch rate was 0.042 shad per hour. This is the lowest catch per effort recorded since the creel census began in 1973. Cumulative data indicate that most shad were taken between 0500 and 1200 EST (Table 13). No correlation between water temperature and shad catch was found. Catches were scattered throughout the range of 53 to 75 F (Table 14). Most shad were taken when one of the smaller units was in operation or during full generation (Table 15).

Noticeable change in fishing effort has been observed. Fishermen appear to be spending more time fishing for species other than shad. In 1979, it was rare to interview more than three or four shad fishermen in a census period.

Angling effort from boats was greatest on the east side of the tailrace below the large generating units (Table 16). Most fishermen relocate their boats along the east side whenever one or more large units begin generation.

Angler interviews were conducted from 17 April to 12 June with a total of 232 anglers interviewed representing about 12% of total angler hours recorded. Interviews were conducted daily from 1100-1200 EST or whenever fishermen were observed leaving the area. Results of these interviews indicate that fishermen caught an average of 0.61 fish per hour with white perch comprising 61.3% of the catch (Table 17).

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TABLE 1

Susquehanna River flows (expressed as 24 hr average) and water temperatures at Conowingo Dam from 1 April - 30 June 1979. River flow data provided by Susquehanna Electric Company. River temperatures taken at Conowingo Dam Fish Collection Facility. Dash indicates collection facility not operated.

Date	Temp (F)	Flow (cfs)	Date	Temp (F)	Flow (cfs)
Apr 1	-	59,700	May 24	-	30,200
2	-	59,900	25	-	44,900
3	-	61,000	26	-	85,200
4	-	64,600	27	-	99,900
5	-	72,800	28	-	98,900
6	-	78,800	29	-	95,800
7	-	73,200	30	-	88,100
8	-	68,000	31	-	75,100
9	-	62,600	Jun 1	-	64,900
10	-	62,300	2	63.5	56,700
11	-	68,100	3	-	52,600
12	-	90,300	4	65.0	46,900
13	-	91,200	5	-	41,300
14	-	88,100	6	66.5	37,300
15	-	83,900	7	-	36,600
16	-	77,200	8	69.0	30,500
17	48.0	74,000	9	-	28,500
18	-	69,600	10	72.0	26,300
19	49.0	65,000	11	-	27,900
20	-	59,900	12	74.0	24,400
21	51.0	53,200	13	-	23,700
22	-	49,200	14	73.0	21,800
23	56.0	41,500	15	-	21,300
24	-	37,900	16	-	20,600
25	56.0	36,500	17	-	20,000
26	-	34,500	18	-	17,000
27	60.0	35,200	19	-	14,500
28	-	34,800	20	-	15,000
29	61.0	36,500	21	-	16,300
30	62.0	39,300	22	-	9,250
May 1	62.0	42,400	23	-	13,600
2	-	42,300	24	-	13,300
3	63.0	39,300	25	-	10,400
4	-	34,900	26	-	11,200
5	63.0	33,200	27	-	9,000
6	-	36,300	28	-	9,500
7	64.0	32,700	29	-	10,700
8	-	31,900	30	-	13,900
9	64.5	30,900			
10	-	29,400			
11	66.5	26,500			
12	-	26,800			
13	69.5	30,900			
14	71.0	30,300			
15	71.0	28,000			
16	-	27,000			
17	71.5	24,100			
18	71.0	23,300			
19	70.0	21,700			
20	-	21,900			
21	70.0	18,800			
22	-	18,100			
23	70.0	20,100			

TABLE 2

Schedule of velocities and volumes for the Conowingo Dam Fish Collection Facility, 15 April - 14 June 1979.

Period No.	Condition*	Service Unit Gate Settings		Entrance Weir Setting	
		No. 1	No. 2	Depth below tailrace (ft)	Velocity (max. ft/sec)
1	High Flow	35%	75%	5.1	6.0
2	Low Flow	35%	35%	3.1	6.0
3	Extra Low Flow	35%	0%	1.7	6.0

* Approximate water flows (cfs) through the facility are:
High Flow = 265 cfs
Low Flow = 150 cfs
Extra Low Flow = 75 cfs

TABLE 3

List of scientific and common names of fishes collected in the Conowingo Dam Fish Collection Facility, 1979 (according to Bailey, et al., 1970).

Scientific Name	Common Name
Family - Petromyzontidae	**Lampreys**
Petromyzon marinus	Sea lamprey
Family - Anguillidae	**Freshwater Eels**
Anguilla rostrata	American eel
Family - Clupeidae	**Herrings**
Alosa aestivalis	Blueback herring
Alosa pseudoharengus	Alewife
Alosa sapidissima	American shad
Dorosoma cepedianum	Gizzard shad
Family - Salmonidae	**Trouts**
Salmo gairdneri	Rainbow trout
Salmo trutta	Brown trout
Family - Esocidae	**Pikes**
Esox lucius	Northern pike
Esox masquinongy	Muskellunge
E. masquinongy x *E. lucius*	Tiger muskellunge
Family - Cyprinidae	**Minnows and Carps**
Cyprinus carpio	Carp
Notomigonus crysoleucas	Golden shiner
Notropis amoenus	Comely shiner
Notropis hudsonius	Spottail shiner
Notropis spilopterus	Spotfin shiner
Family - Catostomidae	**Suckers**
Carpiodes cyprinus	Quillback
Catostomus commersoni	White sucker
Hypentelium nigricans	Northern hog sucker
Moxostoma macrolepidotum	Shorthead redhorse
Family - Ictaluridae	**Freshwater Catfish**
Ictalurus catus	White catfish
Ictalurus natalis	Yellow bullhead
Ictalurus nebulosus	Brown bullhead
Ictalurus punctatus	Channel catfish
Family - Percichthyidae	**Temperate Basses**
Morone americana	White perch
Morone saxatilis	Striped bass
M. saxatilis x *M. chrysops*	Striped bass x white bass hybrid
Family - Centrarchidae	**Sunfishes**
Ambloplites rupestris	Rock bass
Lepomis auritus	Redbreast sunfish
Lepomis gibbosus	Pumpkinseed
Lepomis macrochirus	Bluegill
Micropterus dolomieui	Smallmouth bass
Micropterus salmoides	Largemouth bass
Pomoxis annularis	White crappie
Pomoxis nigromaculatus	Black crappie
Family - Percidae	**Perches**
Perca flavescens	Yellow perch
Stizostedion vitreum	Walleye

TABLE 4

Numbers of fishes taken in the Conowingo Dam Fish Collection Facility, 15 April-14 June 1979.

Dates	15-21 Apr	22-28 Apr	29 Apr-5 May	6-12 May	13-19 May	20-26 May	2-9 Jun	10-16 Jun	Totals
No. Lifts	28	33	52	34	62	22	38	32	301
Fishing Time (hr)	12	14.2	29.5	14	24.6	8.9	15.4	12.8	131.4
Water Temp (F)	48.0-51.0	56.0-60.0	61.0-63.0	64.0-66.5	69.5-71.5	70	63.5-69.0	72.0-74.0	
Lampreys									
Sea lamprey	-	-	1	2	-	-	-	-	3
Freshwater Eels									
American eel	2	12	39	16	1026	306	69	132	1602
Herrings									
Blueback herring	-	2	1877	15	137	82	12	157	2282
Alewife	1	-	-	-	7	1	-	-	9
American shad	-	1	12	6	19	4	2	6	50
Gizzard shad	33	693	6465	5363	33,779	8074	15,218	5928	75,553
Trouts									
Rainbow trout	-	2	-	2	8	-	-	3	15
Brown trout	2	3	8	16	172	23	66	31	321
Pikes									
Northern pike	-	1	3	-	-	-	-	-	4
Muskellunge	-	5	-	-	-	-	-	-	5
Tiger muskellunge	7	33	42	23	12	6	1	7	131
Minnows and Carp									
Carp	2	46	243	581	7364	2096	565	4070	14,967
Golden shiner	-	-	39	28	192	20	-	25	304
Comely shiner	-	-	-	-	1066	141	-	500	1707
Spottail shiner	2	143	983	401	-	-	-	4	1533
Spotfin shiner	-	-	-	-	40	-	1	-	41
Suckers									
Quillback	2	127	72	79	2080	370	71	2284	5085
White sucker	21	201	138	77	307	37	89	15	885
Northern hog sucker	1	5	-	-	-	-	-	-	6
Shorthead redhorse	33	664	219	248	893	36	119	-	2212

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TABLE 4

Continued.

Dates	15-21 Apr	22-28 Apr	29 Apr-5 May	6-12 May	13-19 May	20-26 May	2-9 Jun	10-16 Jun	Totals
No. Lifts	28	33	52	34	62	22	38	32	301
Fishing Time (hr)	12	14.2	29.5	14	24.6	8.9	15.4	12.8	131.4
Water Temp (F)	48.0-51.0	56.0-60.0	61.0-63.0	64.0-66.5	69.5-71.5	70	63.5-69.0	72.0-74.0	
Freshwater catfish									
White catfish	12	7	16	32	115	190	103	40	515
Yellow bullhead	-	2	8	2	-	-	-	1	13
Brown bullhead	-	9	1	38	198	62	14	26	348
Channel catfish	83	2963	1937	6260	18,128	1653	5799	1364	38,187
Temperate Basses									
White perch	-	101	5527	8966	19,457	2758	5459	833	43,101
Striped bass	-	-	1	5	26	18	57	152	259
Striped bass x White bass	7	13	-	-	-	5	64	184	273
Sunfishes									
Rock bass	-	3	18	8	8	7	-	3	47
Redbreast sunfish	-	-	39	298	1865	520	189	560	3471
Pumpkinseed	-	-	8	8	105	39	25	138	323
Bluegill	-	1	15	50	181	221	35	327	830
Smallmouth bass	6	76	78	64	116	14	9	10	373
Largemouth bass	-	1	2	1	1	-	-	1	6
White crappie	-	-	44	34	138	37	10	121	384
Black crappie	-	1	4	-	5	4	5	34	53
Perches									
Yellow perch	1	10	23	15	218	8	18	70	363
Walleye	28	186	205	161	660	287	491	489	2507
Total	243	5311	18,067	22,799	88,323	17,019	28,491	17,515	197,768

* Includes one recaptured shad on 18 May

TABLE 5

Number of fishes taken in the Conowingo Dam Fish Collection Facility, 1972-1979.

No. Lifts Fishing time (hr)	1979 301 131.4			1972-1979 6406 2416.0		
	Total Fish	%	Fish/ 100 hr	Total Fish	%	Fish/ 100 hr
Lampreys						
Sea lamprey	3	*	2	49	*	2
Freshwater Eels						
American eel	1602	0.81	1219	404,401	5.35	16,738
Herrings						
Blueback herring	2282	1.15	1737	920,830	12.19	38,114
Hickory shad	-	-	-	1346	0.02	56
Alewife	9	*	7	177,898	2.35	7363
American shad	50	0.03	38	969	0.01	40
Atlantic menhaden	-	-	-	12,541	0.17	519
Gizzard shad	75,553	38.20	57,498	1,680,339	22.24	69,550
Trouts						
Lake herring	-	-	-	1	*	**
Rainbow trout	15	0.01	11	600	0.01	25
Brown trout	321	0.16	244	3110	0.04	129
Brook trout	-	-	-	34	*	1
Pikes						
Chain pickerel	-	-	-	12	*	**
Northern pike	4	*	3	12	*	**
Muskellunge	5	*	4	221	*	9
Tiger muskellunge	131	0.07	100	144	*	6
Minnows and Carp						
Goldfish	-	-	-	47	*	2
Carp	14,967	7.57	11,390	129,542	1,71	5362
Golden shiner	304	0.15	231	5688	0.07	235
Comely shiner	1707	0.86	1299	10,782	0.14	446
Spottail shiner	1533	0.78	1167	21,943	0.29	908
Roseface shiner	-	-	-	1	*	**
Spotfin shiner	41	0.02	31	79,186	1.05	3278
Longnose dace	-	-	-	5	*	**
Suckers						
Quillback	5085	2.57	3870	83,309	1.10	3448
White sucker	885	0.45	674	3631	0.05	150
Creek chubsucker	-	-	-	7	*	**
Northern hog sucker	6	*	5	16	*	509
Shorthead redhorse	2212	1.12	1683	12,293	0.16	509
Freshwater catfish						
White catfish	515	0.26	392	26,433	0.35	1094
Yellow bullhead	13	0.01	10	184	*	8
Brown bullhead	348	0.18	265	14,654	0.19	607
Channel catfish	38,187	19.31	29,062	677,364	8.97	28,037
Killifishes						
Mummichog	-	-	-	1	*	**
Needlefishes						
Atlantic needlefish	-	-	-	2	*	**
Silversides						
Tidewater silverside	-	-	-	1	*	**
Temperate basses						
White perch	43,101	21.80	32,801	3,137,925	41.53	129,881
Striped bass	259	0.13	197	13,841	0.18	573
Striped bass x White bass	273	0.14	208	662	0.01	27

continued

TABLE 5

Continued.

No. Lifts Fishing time (hr)	1979 301 131.4			1972-1979 6406 2416.0		
	Total Fish	%	Fish/ 100 hr	Total Fish	%	Fish/ 100 hr
Sunfishes						
Rock bass	47	0.02	36	608	0.01	25
Redbreast sunfish	3471	1.76	2642	32,168	0.43	1331
Green sunfish	-	-	-	456	0.01	19
Pumpkinseed	323	0.16	246	17,439	0.23	722
Bluegill	830	0.42	632	21,814	0.29	903
Lepomis hybrid	-	-	-	8	*	**
Smallmouth bass	373	0.19	284	2405	0.03	100
Largemouth bass	6	*	5	270	*	11
White crappie	384	0.19	292	28,282	0.37	1171
Black crappie	53	0.03	40	895	0.01	37
Perches						
Tessellated darter	-	-	-	7	*	**
Banded darter	-	-	-	1	*	**
Yellow perch	363	0.18	276	13,531	0.18	560
Logperch	-	-	-	4	*	**
Walleye	2507	1.27	1908	17,361	0.23	719
Total	197,768		150,509	7,555,488		312,715

* Less than 0.005%
** Less than 1

TABLE 6

Application of alternate day sampling design to 1977 data, and results of expansion of 1978 data.

	Total 1977 Catch*	Alternate Day Catch**	% of Total	Total 1979 Catch	Expanded 1979 Catch
Blueback herring	24,395	21,805	89.4	2,282	2,553
Alewife	188	48	25.5	9	35
American shad	165	140	84.8	49	58
Total	24,748	21,993	88.9	2,340	2,646

* Includes daily totals from 15 April to 16 June
** Includes catch on days of additional operation for anadromous fishes

TABLE 7

Sex ratio and spawning condition of American shad, Alosa sapidissima, collected in the Conowingo Dam Fish Collection Facility, 1972 to 1979.

Sex	Male			Female						
Condition	Ripe	Spent	Total	Green	Ripe	Spent	Undetermined	Total	Undetermined	Total
1979	20	0	20	16	0	8	5	29	0	49*
%	40.8	0	40.8	32.7	0	16.3	10.2	59.2	0	
1972-1979	268	1	268	112	15	59	179	365	334	967**
%	27.7	0.1	27.8	11.6	1.5	6.1	18.5	37.7	34.5	

* Does not include one recaptured shad (male) taken on 18 May and originally tagged on 13 May
** Does not include recaptured shad

TABLE 8

Comparison of the numbers of American shad, Alosa sapidissima, taken in the Conowingo Dam Fish Collection Facility with water temperatures, 1972-1979.

Temp (F)	1972-1978		1979		Total	
	No.	%	No.	%	No.	%
53	1	0.1	-	-	1	0.1
54	1	0.1	-	-	1	0.1
56	6	0.7	-	-	6	0.7
57	3	0.3	-	-	3	0.3
58	6	0.7	-	-	6	0.7
59	6	0.7	-	-	6	0.7
60	7	0.8	1	2.0	8	0.8
61	6	0.7	10	20.0	16	1.6
62	8	0.9	1	2.0	9	0.9
63	5	0.5	1	2.0	6	0.5
64	10	1.1	3	6.0	13	1.3
65	9	1.0	1	2.0	10	1.0
66	17	1.8	3	6.0	20	2.1
67	12	1.3	-	-	12	1.3
68	36	3.9	-	-	36	3.9
69	56	6.1	-	-	56	6.1
70	248	26.9	14	28.0	266	27.4
71	99	10.7	4	8.0	103	10.6
72	20	2.2	9	18.0	29	3.0
73	38	4.1	1	2.0	39	4.0
74	132	14.3	1	2.0	133	13.7
75	163	17.7	-	-	163	17.7
76	26	2.8	-	-	26	2.8
77	2	0.2	-	-	2	0.2
79	4	0.4	-	-	4	0.4
Total	921		50		971	

TABLE 9

Number of American shad, Alosa sapidissima, taken at the Conowingo Dam Fish Collection Facility under various conditions of generation of the Conowingo Hydroelectric Station, 1972-1979.

No. Units Operating		Status of	Status of	No. Shad Caught			% of Catch		
Small*	Large**	Unit No. 1	Unit No. 2	1972-78	1979	Total	1972-78	1979	Total
0	0	Off	Off	188	-	188	20.4	-	20.4
1	0	Off	On	345	29	374	37.5	58	38.5
1	0	Off	Off	37	-	37	4.0	-	4.0
1	0	On	Off	1	-	1	0.1	-	0.1
2	0	Off	Off	1	-	1	0.1	-	0.1
2	0	Off	On	20	-	20	2.2	-	2.2
3	0	Off	On	33	-	33	3.6	-	3.6
3	0	Off	Off	1	-	1	0.1	-	0.1
3	1	Off	On	6	-	6	0.7	-	0.7
4	0	Off	On	35	2	37	3.8	4.0	3.9
4	0	Reduced	On	8	-	8	0.9	-	0.9
4	1	Off	On	43	3	46	4.7	6.0	4.8
4	1	Reduced	On	5	-	5	0.5	-	0.5
4	1	On	On	1	-	1	0.1	-	0.1
4	2	Off	Off	1	-	1	0.1	-	0.1
4	2	Off	On	28	-	28	3.0	-	3.0
4	2	On	On	1	-	1	0.1	-	0.1
4	2	Reduced	On	1	-	1	0.1	-	0.1
4	3	Off	On	17	-	17	1.8	-	1.8
4	3	Reduced	On	1	-	1	0.1	-	0.1
4	4	Off	On	12	1	13	1.3	2.0	1.3
4	4	On	On	6	1	7	0.7	2.0	0.7
5	0	Off	On	4	-	4	0.4	-	0.4
5	1	Off	On	2	-	2	0.2	-	0.2
5	2	Off	On	5	-	5	0.5	-	0.5
5	3	Off	On	9	2	11	1.0	4.0	1.1
5	4	Off	On	5	2	7	0.5	4.0	0.7
6	0	On	On	1	-	1	0.1	-	0.1
6	1	Off	On	3	-	3	0.3	-	0.3
6	2	On	On	1	-	1	0.1	-	0.3
6	3	On	On	4	-	4	0.4	-	0.4
6	4	Off	On	20	-	20	2.2	-	2.2
6	4	On	On	6	3	9	0.7	6.0	0.9
7	4	On	On	34	6	40	3.7	12.0	4.1
7	4	Reduced	On	4	-	4	0.4	-	0.4
Changing		Changing		31	1	32	3.4	2.0	3.3
Total				920	50	970			

* 5,000 cfs
** 10,000 cfs

TABLE 10

Time of day American shad, Alosa sapidissima, were taken in the Conowingo Dam Fish Collection Facility, 27 April-14 June 1979.

Date Water Temp (F)	27 Apr 60.0	29 Apr* 61.0	1 May 62.0	5 May 63.0	7 May 64.0	9 May* 64.5	11 May 66.5	13 May 69.5	15 May 71.0	17 May 71.5
Time (EST)										
0400-0459	-	-	-	-	-	-	-	-	1	-
0500-0559	-	2	-	-	-	-	-	-	-	2
0600-0659	1	3	-	-	-	-	1	1	-	1
0700-0759	-	3	-	1	1	1	-	1	-	1
0800-0859	-	2	-	-	-	-	-	4	-	1
0900-0959	-	-	-	-	-	-	1	2	-	-
1000-1059	-	-	1	-	-	-	1	-	-	-
1100-1159	-	-	-	-	1	-	-	1	-	-
Total	1	10	1	1	2	1	3	9	1	5

TABLE

Continued.

Date Water Temp (F)	18 May 71.0	19 May* 70.0	21 May 70.0	23 May 70.0	4 Jun 65.0	10 Jun 72.0	12 Jun 74.0	14 Jun 73.0	1979		1972-1978		Total	
									No.	%	No.	%	No.	%
Time (EST)														
0400-0459	-	-	-	-	-	-	-	-	1	2.0	9	1.1	10	1.1
0500-0559	-	-	1	-	-	-	-	1	6	12.0	82	9.6	88	9.8
0600-0659	-	-	-	-	-	-	-	-	7	14.0	253	29.7	260	28.9
0700-0759	1	-	-	1	1	1	-	-	12	24.0	200	23.5	212	23.5
0800-0859	-	-	-	-	-	1	-	-	8	16.0	158	18.6	166	18.4
0900-0959	2	-	-	-	-	1	1	-	7	14.0	65	7.6	72	8.0
1000-1059	-	1	-	-	1	-	-	-	4	8.0	47	5.5	51	5.7
1100-1159	-	-	1	1	-	1	-	-	5	10.0	37	4.3	42	4.7
Total	3	1	2	2	1	4	1	1	50		851		901	

* Morpholine release dates

TABLE 11

Age composition of adult American shad, Alosa sapidissima, taken in the Conowingo Dam Fish Collection Facility and by anglers, 1972-1979.

Age Group	Collection Facility		Anglers		Total	%
	Males	Females	Males	Females		
			1972			
III	8	-	-	-	8	8.2
IV	37	15	-	-	52	53.1
V	10	19	-	-	29	29.6
VI	-	9	-	-	9	9.2
			1973			
IV	1	-	-	-	1	16.7
V	1	2	-	-	3	50.0
VI	-	1	-	-	1	16.7
VII	-	1	-	-	1	16.7
			1974			
III	1	-	4	-	5	11.1
IV	2	1	7	14	24	53.3
V	2	3	2	8	15	33.3
VI	-	-	-	1	1	2.2
			1975			
IV	4	7	15	9	35	68.6
V	-	2	4	8	14	27.5
VI	-	-	1	1	2	3.9
			1976			
III	-	-	1	-	1	2.1
IV	4	3	7	8	22	45.8
V	2	8	2	8	20	41.7
VI	2	1	1	-	4	8.3
VII	-	1	-	-	1	2.1
			1977			
III	-	-	2	-	2	2.1
IV	2	6	18	5	31	32.3
V	2	8	13	33	56	58.3
VI	-	-	-	7	7	7.3
			1978			
V	2	1	8	6	17	43.6
VI	-	2	4	12	18	46.1
VII	-	2	1	1	4	10.3
			1979			
III	1	-	-	-	1	1.4
IV	4	3	2	1	10	14.7
V	7	17	3	7	34	50.0
VI	6	8	1	4	19	27.9
VII	2	1	-	1	4	5.9
Total	100	121	96	134	451	

TABLE 12

Daily angler effort and number of American shad, Alosa sapidissima, caught along the west shore of the Conowingo Dam tailrace, 1979.

Date	Angler Hours	No. shad Caught
17 Apr	0	0
19 Apr	5	0
21 Apr	12	0
23 Apr	0	0
25 Apr	0	0
27 Apr	13	0
29 Apr	31	0
30 Apr	25	1
1 May	33	1
3 May	19	0
5 May	36	1
7 May	13	0
9 May	12	0
11 May	15	1
13 May	52	7
14 May	19	2
15 May	15	0
17 May	18	0
18 May	11	0
19 May	19	0
21 May	18	2
23 May	11	2
2 Jun	38	2
4 Jun	14	0
6 Jun	17	0
8 Jun	3	0
10 Jun	1	0
12 Jun	2	0
Total	452	19
No. Days	28	
Average Per Day	16.1	.7
Catch per Angler hr		.042

TABLE 13

Hourly catch of American shad, Alosa sapidissima, by anglers fishing from shore just downstream from the Conowingo Dam Fish Collection Facility.

Date	30 Apr	1 May	5 May	11 May	13 May	14 May	21 May	23 May	2 Jun		1973-1979	
Water Temp (F)	62.0	62.0	63.0	66.5	69.5	71.0	70.0	70.0	63.5			
Shad Angler Hrs	25	33	36	15	52	19	18	11	38	Total	No. Shad	X
Time EST												
0400-0459	-	-	-	-	-	-	-	-	-	-	1	0.2
0500-0559	-	-	-	-	-	-	1	-	1	2	32	7.0
0600-0659	-	-	-	-	-	-	-	-	-	-	80	17.6
0700-0759	-	-	-	-	-	-	-	2	-	2	75	16.5
0800-0859	-	1	-	-	-	-	1	-	1	3	72	15.9
0900-0959	-	-	-	-	3	2	-	-	-	5	85	18.7
1000-1059	1	-	-	1	3	-	-	-	-	5	59	13.0
1100-1159	-	-	1	-	1	-	-	-	-	2	50	11.0
Total	1	1	1	1	7	2	2	2	2	19	454	

TABLE 14

Comparison of the percentage of American shad, Alosa sapidissima, taken by shore anglers just downstream of the Conowingo Dam Fish Collection Facility with water temperature 1973-1979. No angler survey conducted in 1972.

Temp (F)	1973-1978		1979		Total	
	No.	%	No.	%	No.	%
53	2	0.4	0	-	2	0.4
56	1	0.2	0	-	1	0.2
57	13	2.7	0	-	13	2.6
58	14	2.9	0	-	14	2.8
59	17	3.5	0	-	17	3.3
60	22	4.5	0	-	22	4.3
61	43	8.8	0	-	43	8.4
62	55	11.2	2	10.5	57	11.2
63	69	14.1	1	5.3	70	13.8
64	38	7.8	2	10.5	40	7.8
65	13	2.7	0	-	13	2.6
66	58	11.8	0	-	58	11.4
67	1	0.2	1	5.3	2	0.4
68	65	13.3	0	-	65	12.8
69	12	2.4	0	-	12	2.4
70	23	4.7	11	57.9	34	6.7
71	3	0.6	2	10.5	5	1.0
72	12	2.4	0	-	12	2.4
73	10	2.0	0	-	10	2.0
74	14	2.9	0	-	14	2.8
75	5	1.0	0	-	5	1.0
	490		19		509	

TABLE 15

Status of generation of Conowingo Hydroelectric Station in relation to west shore angler catch of American shad, Alosa sapidissima. No angler survey in 1972.

No. Units Operating		Status of	Status of	No. Shad Caught			% Catch		
Small*	Large**	Unit No. 1	Unit No. 2	1973-1978	1979	Total	1973-1978	1979	Total
0	0	Off	Off	2	0	2	0.4	-	0.3
1	0	Off	On	149	10	159	30.4	52.6	31.2
2	0	Off	On	8	0	8	1.6	-	1.6
3	0	Off	On	14	0	14	2.9	-	2.8
3	3	On	On	1	0	1	0.2	-	0.2
4	0	Off	On	12	0	12	2.4	-	2.4
4	0	Reduced	On	14	0	14	2.9	-	2.8
4	0	On	On	2	0	2	0.4	-	0.3
4	1	On	On	-	1	1	-	5.3	0.2
4	1	Off	On	12	0	12	2.4	-	2.4
4	1	Reduced	On	1	0	1	0.2	-	0.2
4	2	Off	On	6	0	6	1.2	-	1.2
4	2	On	On	5	0	5	1.0	-	1.0
4	2	On	Off	4	0	4	0.8	-	0.8
4	3	Off	On	10	0	10	2.0	-	2.0
4	3	On	On	7	0	7	1.4	-	1.4
4	4	Off	On	11	0	11	2.2	-	2.2
4	4	On	On	11	0	11	2.2	-	2.2
5	1	Reduced	On	1	0	1	0.2	-	0.2
5	3	Reduced	On	6	0	6	1.2	-	1.2
5	4	Off	On	9	0	9	1.8	-	1.8
5	4	On	On	6	0	6	1.2	-	1.2
6	4	Off	On	13	0	13	2.7	-	2.6
6	4	On	On	22	1	23	4.5	5.3	4.5
7	3	On	On	4	0	4	0.8	-	0.8
7	4	On	On	120	7	127	24.5	36.8	25.0
7	4	Reduced	On	9	0	9	1.8	-	1.8
Changing		Changing		5	0	5	1.0	-	1.0
Undetermined				26	0	26	5.3	-	5.1
Total				490	19	509			

* 5,000 cfs unit
** 10,000 cfs unit

TABLE 16

The distribution of boats in the Conowingo Dam tailrace under various conditions of generation of Conowingo Hydroelectric Station, 1973-1979.

No. Units Operating		No. Boat Hrs East Side			No. Boat Hrs West Side			% East Side			% West Side		
Small*	Large**	1973-1978	1979	Total	1973-1978	1979	Total	1973-1978	1979	Total	1973-1978	1979	Total
0	0	55	0	55	76	0	76	42.0	-	42.0	58.0	-	58.0
1	0	186	5	191	557	60	617	25.0	7.7	23.6	75.0	92.3	76.4
2	0	37	0	37	98	0	98	27.4	-	27.4	72.6	-	72.6
3	0	50	2	52	67	8	75	42.7	20.0	40.9	57.3	80.0	59.1
4	0	167	0	167	215	0	215	43.7	-	43.7	56.3	-	56.3
5	0	3	0	3	8	0	8	27.3	-	27.3	72.7	-	72.7
0	1	3	0	3	0	0	0	100.0	-	100.0	-	-	-
3	1	7	0	7	5	0	5	58.3	-	58.3	41.7	-	41.7
4	1	251	23	274	115	11	126	68.6	67.6	68.5	31.4	32.4	31.5
5	1	7	0	7	2	0	2	77.8	-	77.8	22.2	-	22.2
3	2	29	0	29	7	0	7	80.5	-	80.5	19.4	-	19.4
4	2	242	0	242	65	1	66	78.8	-	78.6	2112	100.0	21.4
5	2	22	0	22	4	0	4	84.6	-	84.6	15.4	-	15.4
6	2	7	0	7	0	0	0	100.0	-	100.0	-	-	-
3	3	11	4	15	2	0	2	84.6	100.0	88.2	15.4	-	11.8
4	3	221	14	235	49	0	49	81.9	100.0	82.7	18.1	-	17.3
5	3	75	0	75	9	0	9	89.3	-	89.3	10.7	-	10.7
6	3	13	5	18	3	1	4	81.3	83.3	81.8	18.7	16.7	18.2
7	3	77	0	77	7	0	7	91.7	-	91.7	8.3	-	8.3
3	4	14	0	14	5	0	5	73.7	-	73.7	26.3	-	26.3
4	4	171	23	194	17	3	20	90.9	88.5	90.7	9.0	11.5	9.3
5	4	130	9	139	13	1	14	90.9	90.0	90.8	9.1	10.0	9.2
6	4	199	51	250	23	0	23	89.6	100.0	91.6	10.4	-	8.4
7	4	1895	86	1981	288	13	301	86.8	86.9	86.8	13.2	13.1	13.2
Changing		40	5	45	3	6	9	93.0	45.5	83.3	7.0	54.5	16.7
Total		3912	227	4139	1638	104	1742	70.5	68.6	70.4	29.5	31.4	29.6

* 5,000 cfs unit
** 10,000 cfs unit

TABLE 17

Fishing pressure, mean catch per effort and catch composition of anglers interviewed along the West shore of the Conowingo tailrace.

	Apr	May	Jun	Survey Totals
Total Angler Hours*	588	863	420	1871
No. Parties Interviewed	48	88	21	157
No. Anglers Contacted	70	133	29	232
Hours Fished	212	412.2	122.5	746.7
Mean Catch per Effort (all species)	0.26	0.43	1.80	0.61

Species				Number	%
White perch	9	78	190	277	61.28
Blueback herring	6	32	-	38	8.41
White bass x Striped bass	11	-	16	27	5.97
Smallmouth bass	17	8	1	26	5.75
Carp	-	17	-	17	3.77
American shad	1	13	-	14	3.10
White crappie	1	9	-	10	2.21
Walleye	6	1	2	9	1.99
Channel catfish	-	1	7	8	1.78
Bluegill	-	1	3	4	0.88
Striped bass	-	2	2	4	0.88
Tiger musky	2	2	-	4	0.88
Yellow perch	-	4	-	4	0.88
Largemouth bass	1	1	-	2	0.45
Redbreast sunfish	-	2	-	2	0.45
Redhorse sucker	-	2	-	2	0.45
Rock bass	1	1	-	2	0.45
Quillback	-	1	-	1	0.23
White sucker	-	1	-	1	0.23
Totals	55	176	221	452	

* In past years only the number of shad anglers was recorded. In 1979, both the number of shad anglers and the total number of all fishermen was recorded. Thus, category represents all fishermen.